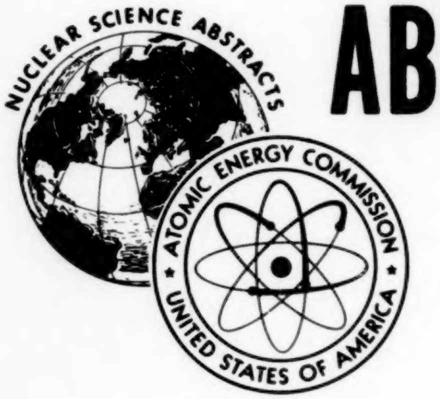
# NUCLEAR SCIENCE ABSTRACTS



Volume 29 Number 1

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January 15, 1974

UNITED STATES ATOMIC ENERGY COMMISSION

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Volume 29, Number 1, January 15, 1974

# NUCLEAR SCIENCE ABSTRACTS

*A semimonthly publication of the USAEC Office of Information Services, John A. Harris, Director.*
*Published by the USAEC Technical Information Center, Robert L. Shannon, Manager.*

*Nuclear Science Abstracts* provides the only comprehensive abstracting and indexing coverage of the international nuclear science literature. It covers scientific and technical reports of the U. S. Atomic Energy Commission and its contractors, other U. S. Government agencies, other governments, universities, and industrial and research organizations. In addition, books, conference proceedings, individual conference papers, patents, and journal literature on a worldwide basis are abstracted and indexed. Each issue of *Nuclear Science Abstracts* includes four indexes: subject, personal author, corporate author, and report number.

The following organizations scan and abstract the nuclear science literature in their respective countries for input to the International Nuclear Information System of the International Atomic Energy Agency. By special agreement, the input to INIS is simultaneously sent to the USAEC Technical Information Center to enhance the timeliness of coverage of that literature in *Nuclear Science Abstracts.*

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Numerous organizations, societies, and publishers throughout the world provide *Nuclear Science Abstracts* with advance page-proof copy of their publications.

A list of the journals scanned regularly and the abbreviations used appears in the January 15 issue of *Nuclear Science Abstracts* and is supplemented in the July 15 issue. The January 15 issue also describes the scope and arrangement of the subject matter covered in *Nuclear Science Abstracts.* The subject matter covered is also described in TID-4552, *Subject Scope of Nuclear Science Abstracts,* available free from the USAEC Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830. An outline of the subject categories appears in the Contents of each issue.

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## Personal Authors

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

**COX, S.H,** DNA replication of induced prophage in
Haemophilius influenzae, 28:18453
**CRANDALL, J.L,** Californium-252 neutron sources, 28:18415
(DP-MS-72-45)
**CRAWFORD, J.F,** Electron multiplication in cavities,
28:18990

## Subjects

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

Examples:

**REACTORS/RESEARCH PROGRAMS**
Institute of Nuclear Research two-year-book, 1970--1971,
28:19902 (INR--1410)
**RED DWARF STARS/STAR EVOLUTION**
Perturbing aspects of the companions of Barnard's star,
28:19287
**REFRACTORIES/ELECTRON MICROSCOPY**
Electron microscope for investigation of metals at high
temperature, 28:18834

## Corporates

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

**19981** (ORNL-4804) $^{238}$U NEUTRON ELASTIC-SCATTERING CROSS SECTIONS FROM 6.44 TO 8.56 MeV. Kinney, W. E.; Perey, F. G. **(Oak Ridge National Lab., Tenn.).** Jun 1973. Contract W-7405-eng-26. 17p. Dep. NTIS $4.00.

is indexed as:

**OAK RIDGE NATIONAL LAB., TENN.**
$^{238}$U neutron elastic-scattering cross sections from 6.44
to 8.56 MeV, 28:19981 (ORNL-4804)
Analytical techniques for determining levels and fates of
trace elements in a fossil-fueled steam plant,
28:17850 (CONF-730817-1)

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Dissertations from *Dissertation Abstracts International, Part B* that are included in *Nuclear Science Abstracts* are available from University Microfilms, Inc., 315 N. First Street, Ann Arbor, Michigan 48103.

Information on the availability of the published literature and unpublished conference papers abstracted in *Nuclear Science Abstracts* can be obtained from the USAEC Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

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Volume 29, Number 1 January 15, 1974

# NUCLEAR SCIENCE ABSTRACTS

## CHEMISTRY

1 (AECL–4509) CHEMISTRY AND MATERIALS DIVISION PROGRESS REPORT, JANUARY 1, 1973 – MARCH 31, 1973. (Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.). Apr 1973. 116p. (PR-CMa–24). Dep. NTIS (U. S. Sales Only) $8.00. AECL $2.50.

Research is reported in the fields of solid-state science, general chemistry, physical chemistry, and materials science. New, previously unreported results include anisotropy of damage in ion-implanted GaAs and GaP, cross section and excitation curve for $^{127}I(n,2n)^{126}I$; sources of He production in thermal neutron-irradiated Ni-based alloys; calculated bulk and perpendicular surface Debye temperatures of metals from Morse potentials; solubility of $NiTeO_3$; $^{60}Co$ activities and Fe deposition rates on CANDU fuel bundles, electrochemical H/D separation factors on Fe, Mo, and W electrodes; H yields and isotope effects from Febetron radiolysis of water vapor; comparison of calorimetric and chemical dosimeters for reactor dosimetry; spectra and solvated electron yield in pulse-irradiated biphenyl–ethylamine and pyrene–methylamine solutions; $^{39}K$ NMR in methylamine; stress-corrosion cracking of Zircaloy and Zr alloys in aqueous chloride, organic, and iodine–organic solutions; oxidation and polarization of Zr alloys in fused salt; electron diffraction and microscopy of $ZrO_2$ films grown in NaCl and iodine-containing environments; thermoluminescence of CO-annealed $ThO_2$; dislocations produced by hydride precipitation in Zircaloy-2; $^{64}Cu$ diffusion in $\alpha$-Zr and $\alpha$-Zr–O alloys; thermal desorption studies of oxygen/platinum interaction; effects of urea and guanidine on $H_2$ and $D_2$ evolution at Fe; and isotope effect on current–potential relations at Fe. (DLC)

2 COMPREHENSIVE INORGANIC CHEMISTRY. Volume 4. Trotman-Dickenson, A. F. (ed.). Oxford; Pergamon Press Ltd. (1973). 1023p.

These review articles on the chemistry of the lanthanides and transition elements are presented under the following chapter titles: the lanthanides; carbonyls, cyanides, and nitrosyls; compounds of the transition elements involving metal–metal bonds; transition metal hydrogen compounds; nonstoichiometric compounds: an introductory essay; tungsten bronzes and related compounds; isopolyanions and heteropolyanions; transition metal chemistry; and organo-transition metal compounds and related aspects of homogeneous catalysis. The chapter on the lanthanides is abstracted separately for NSA. (JGB)

*For an abstract of an individual chapter see: 14.*

3 COMPREHENSIVE INORGANIC CHEMISTRY. Volume 3. Trotman-Dickenson, A. F. (ed.). Oxford; Pergamon Press Ltd. (1973). 1400p.

A comprehensive review of the elements of Groups IB, IIB, IIIA, IVA, VA, VIA, VIIA, and VIII is presented. Nine chapters were abstracted separately for NSA. The chapters on Cu, Ag, Au, Ti, Mn, Fe, Co, and Ni were not. (JGB)

*For abstracts of individual chapters see: 9–13, 84, and 990–992.*

### Analytical and Separations Chemistry

*Refer also to abstracts 2, 220, 235, and 1003.*

4 (NBL–267) ANNUAL PROGRESS REPORT FOR THE PERIOD JULY 1972 THROUGH JUNE 1973. (USAEC New Brunswick Lab., N. J.). Sep 1973. 117p. Dep. NTIS $5.45.

Separate abstracts were prepared for each section of the report. (DHM)

*For abstracts of individual sections see: 5, 6, 39–56, 88, 89, 152, 232, 496, 2382, and 2383.*

5 (NBL-267, pp 80) SUMMARY OF AN INTERLABORATORY COMPARISON PROGRAM ON THE ANALYSIS OF PYROCARBON- AND SILICON CARBIDE-COATED URANIUM–THORIUM CARBIDE BEADS. Bingham, C. D.; Whichard, J. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

NBL conducted an interlaboratory comparison program on the analysis of pyrocarbon- and silicon carbide-coated uranium–thorium carbide nuclear fuel beads. Samples of the beads from a single production lot, and synthetic uranium dioxide–thorium dioxide mixtures were analyzed for uranium by 3 laboratories by nondestructive assay techniques, and for uranium and thorium by 7 laboratories by destructive chemical procedures. (auth)

6 (NBL-267, pp 107-108) GENERAL ANALYTICAL EVALUATION (GAE) PROGRAM FOR URANIUM HEXAFLUORIDE. Bingham, C. D. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

A new GAE program for uranium hexafluoride has been started. Phase I involving the determination of uranium content and isotopic abundance began June 1, 1973 with 20 laboratories including 11 foreign laboratories participating. (auth)

7 DETERMINATION OF RARE EARTHS IN GEOLOGICAL SAMPLES AND RAW MATERIALS. Haskin, L. A.; Korotev, R. (World Meteorological Organization, Geneva). pp 183-211 of Analysis and Application of Rare Earth Materials. Michelsen, O. B. (ed.). Oslo; Universitetsforlaget (1973).

From NATO Advanced Study Institute; Kjeller, Norway (23 Aug 1972).

The relative abundances of the rare earth elements (REE) in rocks and minerals are related to those of the chondritic meteorites, which are believed to have preserved the REE with the same relative abundances as were present in the primitive matter from which the planetary bodies in the solar system developed. The relationships among relative REE abundances in different materials are most easily seen through the use of comparison diagrams with chondritic meteorites or with more immediately related materials. On such diagrams, differences in relative REE abundances between two materials appear, except for Ce and Eu, as smooth functions of REE atomic number. This is a consequence of the type of chemical separations that accompany rock-forming processes. Accurate and sensitive geochemical analysis is now done mostly by neutron activation analysis or mass spectrometric isotope dilution, sometimes on nanogram and subnanogram quantities of the individual REE. Precision for isotope dilution is a fraction of a percent, that for neutron activation ranges from about ±1% to about ±10%, depending on the element. Useful data are also obtained by spark-source mass spectrometry and x-ray fluorescence, with precision ranging upwards from about ±10%. Because all rocks and minerals apparently give smooth curves on comparison diagrams with chondritic meteorites, very accurate concentrations for unanalysed REE can be obtained by interpolation on comparison diagrams drawn through ratios for carefully analysed REE. Reasonably good estimates for most of the REE can be obtained from estimated comparison diagrams based on analyses for as few as 4 of the REE. (auth)

**8** BIBLIOGRAPHY OF COLUMN CHROMATOGRAPHY 1967–1970 AND SURVEY OF APPLICATIONS. J. Chromatogr.; Suppl. Vol. No. 3: 1-1067(1973).

A bibliography on column chromatography is presented that includes both purely methodological progress and applications. A section is devoted to inorganic compounds, including uranium, rare earths, transuranium elements, protactinium, and actinides. Another section considers radioactive substances and includes application of column chromatography in activation analysis. (DHM)

**9** ZIRCONIUM AND HAFNIUM. Bradley, D. C.; Thornton, P. (Queen Mary Coll., London). pp 419-490 of Comprehensive Inorganic Chemistry. Volume 3. Trotman-Dickenson, A. F. (ed.). Oxford; Pergamon Press Ltd. (1973).

Zirconium and hafnium are discussed from the standpoint of history, occurrence, nuclear, physical, chemical, and biological properties, analytical chemistry, and separation. Compounds and complexes are discussed in detail with extensive information on properties being presented in tabular form. (270 references) (JGB)

**10** CHEMISTRY OF NIOBIUM AND TANTALUM. Brown, D. (Atomic Energy Research Establishment, Harwell, Eng.). pp 553-622 of Comprehensive Inorganic Chemistry. Volume 3. Trotman-Dickenson, A. F. (ed.). Oxford; Pergamon Press Ltd. (1973).

Niobium and tantalum are discussed from the standpoint of history, occurrence, extraction procedures, industrial uses, alloys, nuclear, physical and chemical properties, purification and analytical chemistry. Detailed information is presented on various Nb and Ta compounds and complexes. (284 references) (JGB)

**11** CHROMIUM, MOLYBDENUM, AND TUNGSTEN. Rollinson, C. L. (Univ. of Maryland, College Park). pp 623-769 of Comprehensive Inorganic Chemistry. Volume 3. Trotman-Dickenson, A. F. (ed.). Oxford; Pergamon Press Ltd. (1973).

The history, occurrence, production and industrial uses, alloys, nuclear, physical and chemical properties, and analytical chemistry of Cr, Mo, and W are discussed. Detailed information is presented on various compounds and complexes of the three elements. (679 references) (JGB)

**12** TECHNETIUM. Peacock, R. D. (Univ. of Leicester, Eng.). pp 877-903 of Comprehensive Inorganic Chemistry. Volume 3. Trotman-Dickenson, A. F. (ed.). Oxford; Pergamon Press Ltd. (1973).

Technetium is discussed from the standpoint of its discovery, isolation, physical and chemical properties, analytical chemistry, biological activity, uses, alloys, and intermetallic compounds. Various compounds and complexes are discussed in some detail. (123 references) (JGB)

**13** SECOND- AND THIRD-ROW ELEMENTS OF GROUP VIII A, B, AND C. Livingstone, S. E. (Univ. of New South Wales, Kensington, Australia). pp 1163-1370 of Comprehensive Inorganic Chemistry. Volume 3. Trotman-Dickenson, A. F. (ed.). Oxford; Pergamon Press Ltd. (1973).

The platinum metals, Ru, Os, Rh, Ir, Pd, Pt, are discussed from the standpoint of history, occurrence, extraction and purification, fabrication, alloys, uses, catalytic applications, and analytical chemistry. The general chemistry and various complexes and compounds of each element are considered separately. (689 references) (JGB)

**14** LANTHANIDES. Moeller, T. (Arizona State Univ., Tempe). pp 1-101 of Comprehensive Inorganic Chemistry. Volume 4. Trotman-Dickenson, A. F. (ed.). Oxford; Pergamon Press Ltd. (1973).

The lanthanides as a group are discussed as to electronic configuration, bonding, coordination number and stereochemistry, and coordination chemistry. The history, occurrence, production, allotropic modifications, nuclear, physical and chemical properties, and analytical chemistry are also reviewed. (380 references) (JGB)

## *Activation and Nuclear Reaction Procedures*

*Refer also to abstracts 411, 804, and 882.*

**15** (BLG-480) CHEMICAL ANALYSIS OF AIR POLLUTANTS. Lievens, F. (Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium)). Apr 1973. 22p. Dep. NTIS (U.S. Sales Only) $3.25.

Analytical methods practical for air pollution control are discussed. Emission spectrography, neutron activation, x-ray fluorescence, and atomic absorption are described, with their application to the determination of metals in airborne particulate. Colorimetric, conductimetric, coulometric, flame photometric, and infrared absorptiometric pollution monitoring instruments are described. The practical methods for the estimation of $SO_2$, $NO_x$, CO, $O_3$, and hydrocarbons are given. (auth)

**16** CONCENTRATIONS OF SOME TRACE METALS IN PELAGIC ORGANISMS AND OF MERCURY IN NORTHEAST ATLANTIC OCEAN WATER. Leatherland, T. M. (Southhampton Univ., Eng.); Burton, J. D.; Culkin, F.; McCartney, M. J.; Morris, R. J. Deep-Sea Res. Oceanogr. Abstr.; 20: No. 8, 679-685(Aug 1973).

Several trace metals (Zn, As, Cd, Sb, and Hg) were determined, by neutron activation analysis, in pelagic organisms, mainly crustaceans and fishes, collected mostly off northwest Africa and in the Azores region. Concentrations of mercury (0.06 to 0.38 ppM dry weight) showed no clear trend with trophic level. Organomercury analyses on two species showed that the element was present largely in the methyl mercuric form. Concentrations of cadmium, which reaches 13 ppM dry weight in Systellaspis deblis and Oplophorus sp., and of arsenic, which averaged 25 ppM dry weight in the crustaceans, tended to decrease in the tissue of fishes. Values for antimony which were all below 0.1 ppM dry weight, showed some indication of a similar trend. Concentrations of mercury in sea water from an adjacent area ranged from 17 to 142 ng/l., the highest concentration occurring in deep water. (auth)

**17** QUANTITATIVE APPLICATIONS OF $^{17}$O TRACER. Carpenter, B. S.; Samuel, D.; Wasserman, I. (National Bureau of Standards, Washington, DC). Radiat. Eff.; 19: No. 1, 59(May 1973).

The use of $\alpha$ tracks from the $^{17}O(n,\alpha)^{14}C$ reaction as a means of oxygen determination and distribution in biological material is described. A determination of oxygen in alumina and citric acid using enriched tracer was made. (auth)

**18** ARSENIC AND ANTIMONY IN LAUNDRY AIDS BY INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS. Tanner, J. T. (Food and Drug Administration, Washington, DC); Friedman, M. H.; Holloway, G. E. Anal. Chim. Acta; 66: No. 3, 456-459(Oct 1973).

The measurement of trace amounts of arsenic and antimony in laundry aids by neutron activation analysis is described. The results for arsenic are compared with those obtained by other analytical techniques. The concentrations in the various laundry aids tested ranged from 5 to 51 ppM of arsenic and from 1 to 8 ppM of antimony. (auth)

**19** DETERMINATION OF IMPURITIES IN SEMICONDUCTOR GRADE SILICON BY THE NEUTRON ACTIVATION METHOD. Zmijewska, W. (Inst. of Nuclear Research, Warsaw). Chem. Anal. (Warsaw); 18: No. 4, 817-823(1973). (In Polish).

Neutron activation was used to determine Ag, Cr, In, and Fe in semiconductor grade silicon. Activity measurements were performed by means of a $\gamma$ scintillation spectrometer after radiochemical separation. The lower limit of the determination is ~1 ng for Ag and In, ~5 ng for Cr and ~50 ng for Fe. (auth)

**20** DETERMINATION OF THE CARBON, OXYGEN, AND NITROGEN CONTENTS OF HUMIC ACID USING A PHOTONUCLEAR REACTION. Kasymov, A. K.; Khakimov, M.; Miller, R. A. (Tashkent State Univ.). Dokl. Akad. Nauk Uzb. SSR; No. 12, 22-23(1972). (In Russian).

The simultaneous determination of C, O, and N in humic acid by employment of a $(\gamma,n)$ reaction was studied. This photonuclear reaction produced the positron-active isotopes $^{11}C$, $^{15}O$, and $^{13}N$ with different half-lives. This method yielded C, O, and N values of 62.3, 31.2, and 1.28% as compared to those from conventional chemical analyses: 64.8, 31.0, and 1.21%, respectively. (KSW)

**21** NATURAL CONCENTRATION OF GALLIUM IN HUMAN TISSUES. Lange, H. H. (Rigshospital, Copenhagen). Nucl. Med.; 12: No. 2, 178-185(1973).

By means of neutron activation analysis it was possible to determine concentrations of gallium in biological material down to $10^{-4}$ ppM (approximately 10 pg/100 mg fresh tissue). Twenty determinations were carried out. The gallium level seems to vary from about $10^{-4}$ ppM in plasma to $10^{-3}$ ppM in liver tissue. There is no apparent difference in the gallium concentration between samples from cancer patients and samples from normal individuals. (auth)

**22** ANALYSIS OF FERROMETALS BY ACTIVATION WITH 14-MeV NEUTRONS. Van Grieken, R. Verh. Kon. Vlaam. Acad. Wetensch., Belg., Kl. Wetensch.; 35: No. 128, 1-125(1973). (In Dutch).

Fundamental aspects and the application of 14-MeV neutron activation analysis to ferrometals as matrix are described. The neutron flux distribution was measured axially and radially for targets of different diameters, and errors from tolerances and positioning are estimated. The well-known method for determination of oxygen in steel was extended with a statistical study of the precision and errors. Determination of silicon was then studied in detail, using the $^{28}$Si (n,p) $^{28}$Al reaction. $^{56}$Mn was used for internal standardization, resulting in a precision of 0.02% Si. Corrections for phosphorus and $^{53}$Fe interferences are discussed. Finally, determination of copper in steels and cast irons using $^{63}$Cu (n,2n) $^{62}$Cu was studied. A computer program allows simultaneous O, Si, P, and Cu determinations in iron and steel. (20 tables, 35 figures, 69 references) (DLC)

**23** NEWBORN SCREENING FOR CYSTIC FIBROSIS WITH THE CHLORIDE ELECTRODE AND NEUTRON ACTIVATION ANALYSIS. Guerson, C. T.; Sertel, H.; Guerkan, M.; Pala, S. (Univ. of Istanbul). Helv. Paediat. Acta; 28: No. 2, 165-174 (1973).

From third annual meeting of the European Working Group of Cystic Fibrosis; Erbach, Germany (6 Sep 1972).

In 6,061 newborns, the chloride electrode technique was used for the detection of cystic fibrosis. The electrolyte values obtained were found to vary with the type of electrode used (45.9 ± 9.9 mEq/l Beckman and 22.3 ± 12 mEq/l Orion), and in both cases a value greater than the mean + 2 standard deviation was held as suspect and retested. In the group studied, the incidence of cystic fibrosis was calculated to be 1 in 3,000. In 590 of these cases the sodium values of nail clippings were measured by neutron activation analysis and were found to differ according to the washing method used; wash in vivo with ethanol 211.26 ± 85.9 mEq/kg water wash and acetone rinse 93.00 ± 47.24 mEq/kg; washing with $H_2O_2$ + absolute ethanol + diethyl ether, 183.42 ± 61.26 mEq/kg. In addition, no correlation was found between chloride in sweat and the sodium content of nails. (auth)

**24** APPARATUS FOR TRANSPORTING SAMPLES. Ehret, R.; Domberg, H.; Lohner, H. (to Gesellschaft fuer Kernforschung mbH). British Patent 1,323,530. 18 Jul 1973. Filed date 28 Oct 1971. 5p.

In activation analysis with short-lived radioisotopes it is necessary to convey an activated sample as quickly as possible to the radiation measuring device to avoid fading out of the activity, as far as possible, before measuring is made. One or more neutron monitors also have to be irradiated, conveyed and measured simultaneously. An object of the apparatus described is to provide a device by means of which the transportation of sample and monitors can be effected in the shortest time to separate measuring positions after activation. The apparatus comprises a carrier capsule provided with locking tong or grip holding means for the sample and monitors, together with unlocking means, and is pneumatically movable along a pipe. A separating device is provided, together with a collecting hopper to receive articles released from the capsule upon operation of the unlocking means. A shaft having inclined members provides inclined surfaces defining a slot and an aperture at the lower end of the members, the slot and aperture leading into shafts communicating with the measuring positions. The width of the slot corresponds to the thickness of the monitors, which is less than that of the samples. (UK)

**25** DETERMINATION OF TRACE AMOUNTS OF ELEMENTS IN ATMOSPHERIC AEROSOLS BY NEUTRON ACTIVATION. Clemente, G. F. (CNEN, Rome). Chim. Ind. (Milan); 54: No. 9, 805-808(1972). (In Italian). (RT/PROT(73)3).

Neutron activation analysis is one of the most powerful techniques for measuring quantitatively a large number of the trace elements present in aerosol samples. A neutron activation method is described for the determination of Na, K, Sc, Cr, Fe, Co, Zn, As, Br, Rb, Cd, Sb, Cs, La, Ce, Eu, Tb, Au, Hg, and Th concentrations in air filters, avoiding any chemical treatment of the sample. The method provides the determination of the average trace elements' concentration present in 50 m$^3$ air filter samples. (auth)

**26** ANALYSIS FOR ORGANICALLY BOUND ELEMENTS (ARSENIC, SELENIUM, AND BROMINE) AND PHOSPHORUS IN RAW, REFINED, BLEACHED, AND HYDROGENATED MARINE OILS PRODUCED FROM FISH OF DIFFERENT QUALITY. Lunde, G. (Central Inst. of Industrial Research, Oslo). J. Amer. Oil Chem. Soc.; 50: No. 1, 26-28(1973).

The sample (0.5 g) is sealed into a silica ampoule and irradiated in a neutron flux of $\approx 5 \times 10^{12}$ thermal neutrons/cm$^2$/sec for 20 hr. The activity is counted on a 400-channel $\gamma$ spectrometer with a NaI well-type crystal. The $^{82}$Br and $^{76}$As are measured 1 to 7 days after irradiation, unless $^{24}$Na is present, when counting must be delayed until interference becomes negligible. The $^{75}$Se is counted when the Br and As isotope activity becomes low enough. The P is determined by measurement of the $^{32}$P bremsstrahlung spectrum, making appropriate correction for $^{75}$Se activity. (Anal. Abstr.)

**27** DETERMINATION OF MAGNESIUM IN PLANT MATERIALS. Bornemisza-Pauspertl, P. (Inst. of Nuclear Research, Debrecen, Hungary). J. Radioanal. Chem.; 14: No. 1, 189-192 (Mar 1973).

A nondestructive neutron activation method for determining magnesium in plant material is described in which a low-concentration standard of $M_gO$ is irradiated along with the sample and a correction factor is used for the Al in the sample. (DHM)

**28** OPTIMIZATION OF PARAMETERS OF A SYSTEM FOR CONTINUOUS ACTIVATION ANALYSIS OF LIQUIDS. Loska, L.; Janczyszyn, J.; Gorski, L. (Inst. of Nuclear Techniques, Krakow). J. Radioanal. Chem.; 14: No. 1, 11-127(Mar 1973).

Mathematical considerations on the optimization of the flow and mechanical parameters of a system for continuous analysis of liquids are presented. The system in question contains a pump, an activation vessel placed in the vicinity of a neutron generator target, a pipeline and a vessel for the measurement of the induced activity. The following parameters of the system were taken into consideration: volumes of the activation and measurement vessels, position of the activation vessel with respect to the neutron generator target, shape of the activation vessel, and flow rate of the pumped fluid. The system is adapted for continuous and interrupted mode of operation of the neutron generator. The results of the theoretical considerations were verified in practice with the use of the above system and the reaction $^{16}$O (n, p) $^{16}$N. The agreement of theory and experiment was proved. (auth)

**29** INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS OF A SULFIDE ORE AND SOME ORE BENEFICIATION PRODUCTS. Steinnes, E.; Mukherjee, A. D. (Inst. for Atomic Energy, Kjeller, Norway). J. Radioanal. Chem.; 14: No. 1, 129-138(Mar 1973).

Samples of a pyritic lead–zinc ore and some beneficiation products were examined by instrumental activation analysis using Ge(Li) gamma-spectrometry. The following elements were determined using thermal neutron activation: Sc, Cr, Co, Zn, As, Se, Ag, Sb, Ir, Au, and Th. The technique is especially favorable for the determination of cobalt, arsenic, antimony and gold, but selenium, silver and thorium can also be determined in most fractions. Activation with epithermal neutrons will improve conditions for the determination of As, Sb, Se, Ag, Au, and Th. (auth)

**30** DETERMINATION OF TRACE ELEMENTS IN IRANIAN CIGARETTE TOBACCO BY NEUTRON ACTIVATION ANALYSIS. Abedinzadeh, Z.; Parsa, B. (Tehran Univ. Nuclear Center, Iran). J. Radioanal. Chem.; 14: No. 1, 139-145(Mar 1973).

The concentration of 24 trace elements in the tobacco of two different brands of Iranian cigaretts, "Zarrin" and "Oshnoo", was measured by neutron activation analysis employing a high-resolution Ge(Li) detector. These elements are: Na, K, Sc, Cr, Mn, Fe, Co, Zn, Se, Br, Rb, Ag, Sb, Cs, Ba, La, Ce, Sm, Eu, Tb, Hf, Au, Hg, and Th. (auth)

**31** SURVEY OF 33 CONSTITUENT ELEMENTS IN HEART TISSUE BY INSTRUMENTAL ACTIVATION ANALYSIS. Velandia, J. A.; Perkons, A. K. (Instituto Venezolano de Investigaciones Cientificas, Caracas). J. Radioanal. Chem.; 14: No. 1, 171-181 (Mar 1973).

Neutron activation analysis and instrumental Ge(Li) gamma-spectrometry were used to determine the amounts of 33 elemental constituents in the heart tissue of rats. A fast ion-exchange group separation scheme was developed for confirmation of the quantitative and qualitative results. The results, in parts per million of dry heart tissue, are given for 26 elements, together with some typical gamma-spectra at various irradiation and decay times. Optimum irradiation and decay periods for the various components are suggested. (auth)

**32** NONDESTRUCTIVE ANALYSIS OF PHOSPHORUS BY NEUTRON ACTIVATION ANALYSIS IN BIOCHEMICAL PRODUCTS. Sabbioni, E.; Clerici, L.; Girardi, F.; Campagnari, F. (Joint Research Center, Ispra, Italy). J. Radioanal. Chem.; 14: No. 1, 159-169(Mar 1973).

A method of neutron activation analysis is described for the quantitative determination of phosphorus in nucleic acids, nucleotides, and glucose-6-phosphate in amounts of 0.1 to 200 $\mu$g, without any chemical separation. This technique may be usefully applied to the measurement of the phosphorus content in organic materials and biochemical preparations. The procedure involves a short neutron activation in a nuclear reactor and measurement of the Cerenkov radiation emitted by the irradiated capsule after a suitable decay period. Possible interferences due to other induced radionuclides are discussed. (auth)

**33** NEUTRON-CAPTURE GAMMA-RAY ACTIVATION ANALYSIS OF REFINED STEEL. Zwittlinger, H. (Oesterreichische Studiengesellschaft fuer Atomenergie, Seibersdorf, Austria). J. Radioanal. Chem.; 14: No. 1, 147-158(Mar 1973).

Nuclear-capture $\gamma$ activation analysis of the elements Cr, Mn, Fe, Co, Ni, and W in refined steel was carried out using a collimated reactor neutron beam and a Ge(Li) detector. A short description of the method, the detector system, electronics, shieldings and sample preparation is given. A correction of iron and chromium peak areas is necessary in the spectra of all samples, because of the scattering of neutrons into the detector system by the samples. This part of the background interference can be evaluated by means of the nuclear capture $\gamma$ of lead (7380 keV). (auth)

## Chemical and Spectral Procedures

*Refer also to abstracts 621, 845, 847, 878, 881, 2366, and 2383.*

**34** (ARH-2745) DIFFERENTIAL SPECTROPHOTOMETRIC DETERMINATION OF PLUTONIUM USING THE CARY MODEL 16 SPECTROPHOTOMETER. Winters, W. I. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Aug 1973. Contract AT(45-1)-2130. 50p. Dep. NTIS $5.45.

The application of a high-precision Cary Model 16 spectrophotometer to the differential spectrophotometric determination of plutonium(III) was investigated. The absorbances of plutonium(III) solutions were measured against colored glass filters at 560 nanometers. Selection of various instrument parameters and the determination of the best reference filter for the highest precision are discussed. Two sets of calibration points were analyzed. The absorbance for each set was measured once a day for three days. A statistical comparison between the three readings, the three least squares curves, and the two sets of calibration points are discussed. The standard deviation of the average reading about the line was ±0.0028 g/liter plutonium in the 11 to 15 g/liter plutonium range. Detailed procedures for standard preparation from plutonium nitrate and for operation of the Cary Model 16 are included. The advantages and disadvantages of the equipment and method are discussed and further experiments suggested. (auth)

**35** (CEA-R-4475) DETERMINATION OF IMPURITIES IN URANIUM–NIOBIUM (7.5%)–ZIRCONIUM (2.5%) ALLOY. Arragon, Y. (CEA Centre d'Etudes de Bruyeres-le Chatel, 92, Montrouge (France)). Oct 1973. 47p. (In French). Dep. NTIS (U.S. Sales Only) $4.50.

The determination of 11 impurities in uranium–niobium–zirconium alloys was studied. Elements of which the alloy is composed are considered and information is given on the determination of niobium by niobic acid precipitation. Selective elimination of the three components is discussed. Two liquid-liquid extractions are used. The niobium is separated by methylisobutylketone in a hydrochloric–hydrofluoric medium and the zirconium and uranium by tributyl phosphate in a nitric medium. The determination of trace elements using electrochemical methods is discussed. Anodic re-dissolution polarography or square wave polarography enabled six elements (cadmium, copper, lead, zinc, bismuth, and thallium) to be determined in a carbonate medium together with aluminium in tetraethylammonium perchlorate, molybdenum in nitric acid, ammonium nitrate, and tungsten in hydrochloric acid with added double sodium and potassium tartrate. Fluorine was determined using ionometric techniques with a specific electrode and carbon was titrated by conductometry after combustion of the sample in an oxygen current. (auth)

**36** (CONF-730525-, pp 261-272) TWO APPROACHES FOR THE ANALYSIS OF THE MASS SPECTRA OF ISOTOPICALLY ENRICHED NATURAL PRODUCTS. Buddenbaum, W. E.; Earl, B. S.; Daves, G. D. Jr. (Oregon Graduate Center, Beaverton). 1973.

From 1st international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

The increased accessibility of stable isotopes is stimulating many new and important applications in widely varied fields of biological, chemical, and medical research. Mass spectrometry has appeared as a highly promising analytical tool for these isotopes; however, to date, its application for detailed isotopic analysis of the multi-enriched molecules produced in these experiments has been limited in spite of the extremely numerous experimental data present in a single spectrum. Two new approaches for detailed isotopic analysis of mass spectral intensity data will be discussed. The first method will be illustrated using intensity data for mass spectral fragmentation ions of a biosynthetically $^{13}$C-enriched Sepedonin. (auth)

**37** (CONF-730525-, pp 291-298) QUANTITATIVE MEASUREMENTS OF ENDOGENOUS AND $^{2}$H-TRACER VARIANTS OF DRUGS AND METABOLITES USING A MULTIPLEXED GC/QUADRUPOLE MASS SPECTROMETER SYSTEM. Jenden, D. J.; Cho, A. K.; Silverman, R. W. (Univ. of California, Los Angeles). 1973.

From 1st international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

A description of a multiplexed quadrupole GC/MS system that was developed for quantitative isotope dilution methods of this type, and two applications that illustrate their sensitivity and versatility are presented. The first is an isotope dilution assay for amphetamine and the second is a procedure for the simultaneous measurement of endogenous and $^{2}$H-labeled tracer variants of choline and acetylcholine. (auth)

**38** (CONF-730525-, pp 452-459) DETERMINATION OF NITRIC OXIDE IN BLOOD BY ISOTOPE DILUTION ANALYSIS. Anbar, M.; Dyer, R. L.; St. John, G. A. (Stanford Research Inst., Menlo Park, CA). 1973.

From 1st international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

Isotope dilution analysis using field ionization mass spectrometry was used for the determination of nitric oxide in blood. Blood exposed to a known amount of $^{15}$NO exchanges any bound $^{14}$NO with excess $^{15}$NO, resulting in an isotopic dilution of the latter. The precision of the method stands at +10%, which seems acceptable for epidemiological or physiological investigations. (JGB)

**39** (NBL-267, pp 6-12) EFFECT OF IMPURITIES ON THE NEW BRUNSWICK LABORATORY TITRIMETRIC METHOD OF DETERMINING URANIUM. II. Platinum Metals, Chloride, and Bromide. Scarborough, J. M.; Bodnar, L. Z. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

Ruthenium, palladium, osmium, iridium, and platinum cause serious positive errors in the determination of uranium by the NBL titrimetric method. Rhodium alone among the platinum metals does not cause any significant error. Chloride causes positive errors apparently not strictly related to the stoichiometric quantity present. In addition, chloride seriously affects the behavior of the platinum electrode. Bromide can cause either positive or negative errors depending upon the amount present. This fact suggests that there are two interfering processes occurring. One milligram or less of bromide can be tolerated. The elimination of their interferences is discussed. (DHM)

**40** (NBL-267, pp 13-16) EFFECT OF IMPURITIES ON THE NEW BRUNSWICK LABORATORY TITRIMETRIC METHOD OF DETERMINING URANIUM. III. Fluoride. Bodnar, L. Z.; Scarborough, J. M. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

Fluoride above certain concentrations was shown to interfere with the NBL titrimetric method for uranium. The interference can be eliminated by an evaporation step or by complexing prior to the determination of uranium. (auth)

**41** (NBL-267, pp 17-18) EFFECT OF IMPURITIES ON THE NEW BRUNSWICK LABORATORY TITRIMETRIC METHOD OF DETERMINING URANIUM. IV. Hydrogen Peroxide. Scarborough, J. M. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

The interference of hydrogen peroxide in the NBL titrimetric method of determining uranium was shown to be due to the depletion of the ferrous ion reductant in the procedure. (auth)

**42** (NBL-267, pp 19-21) ELIMINATION OF SOME INTERFERENCES IN THE NEW BRUNSWICK LABORATORY TITRIMETRIC URANIUM METHOD BY MEANS OF A COPPER COLUMN. Bodnar, L. Z.; Scarborough, J. M.; Lerner, M. W. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

The interference of mercury, platinum and palladium in the NBL titrimetric method for uranium can be eliminated by a copper column technique. (auth)

**43** (NBL-267, pp 22-28) APPLICATION OF THE RADIOMETER TITRATOR MODEL TTT2 TO THE NEW BRUNSWICK LABORATORY TITRIMETRIC METHOD OF DETERMINING URANIUM. Bodnar, L. Z.; Scarborough, J. M. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

The Radiometer Titrator TTT2, a commercially available instrument that automatically titrates a solution to a preselected potential or pH, was evaluated for its applicability to the NBL method of determining uranium. (auth)

**44** (NBL-267, pp 29-31) EVALUATION OF AN AUTOMATIC URANIUM ANALYZER BASED UPON CONSTANT CURRENT COULOMETRY: A PROGRESS REPORT. Goldbeck, C. G.; Lerner, M. W.; Peoples, G. E. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

Evaluation of the automatic uranium analyzer based upon the constant-current generation of vanadium(V) has revealed several modifications that were needed to improve the reliability of results. An unknown factor responsible for slightly negative errors still exists. (auth)

**45** (NBL-267, pp 32-34) DETERMINATION OF URANIUM IN URANIUM—THORIUM SOLUTIONS BY CONTROLLED-POTENTIAL COULOMETRY AT A MERCURY POOL ELECTRODE. Lewis, K. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

**46** (NBL-267, pp 35) CONTROLLED-POTENTIAL COULOMETRIC DETERMINATION OF URANIUM WITH A PLATINUM ELECTRODE AFTER REDUCTION WITH IRON(II) IN PHOSPHORIC ACID. Lewis, K.; Lerner, M. W. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

After reduction to uranium(IV) by the Davies and Gray procedure, uranium can be determined by controlled-potential coulometry with a platinum electrode by allowing it to react with iron(III) prior to the coulometry. Determinations of 5 to 10 mg of uranium show a relative standard deviation of within 0.1%.

**47** (NBL-267, pp 36-39) X-RAY SPECTROGRAPHIC DETERMINATION OF URANIUM IN LOW-GRADE SAMPLES BY A LITHIUM TETRABORATE FUSION TECHNIQUE: A PROGRESS REPORT. Busch, A. J.; Goldbeck, C. G. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

**48** (NBL-267, pp 70-74) DETERMINATION OF THORIUM IN URANIUM—THORIUM MIXTURES. Scarborough, J. M. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

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**57** APPLICATION OF TRI-N-BUTYL PHOSPHATE AND THIOCYANATE IONS TO MOLYBDENUM DETERMINATION. Rozycki, C.; Kaminska, J. (Inst. of General Chemistry and Inorganic Tech., Warsaw). Chem. Anal. (Warsaw); 18: No. 4, 777-780(1973). (In Polish).

A method of colorimetric determination of molybdenum was devised. It consists in extraction of the molybdenum thiocyanate complex with 15% solution of TBP in $CHCl_3$. There is no interference from iron (30 mg), tungsten (1.5 mg), nickel (15 mg), manganese (15 mg), zinc (15 mg), chromium(III) (15 mg), cobalt (15 mg), vanadium(V) (10 mg), and titanium (0.2 mg); however, niobium interferes, but its influence may be eliminated by measuring absorption at 390 and 470 nm and solving a system of equations with two unknowns. To perform the determination: to the molybdenum solution (ab. 20 $\mu$g Mo) in a separating funnel of 25 ccm capacity 1.5 ccm of 9 M HCl, 3.0 ccm of 3 M KSCN, 3 ccm of 20% ascorbic acid, 0.1 ml of 4% solution of $CuSO_4$ in 0.36 N $H_2SO_4$ are added and filled up to 7.5 ccm with water. After 5 min 5 ccm of 15% TBP in $CHCl_3$ is added, and extracted for 30 sec. When phases are separated, the organic phase is transferred to a measuring flask of 10 ccm capacity, filled up with chloroform to the mark and absorbancy is measured (after 10 to 15 min) at 390 and 470 nm in respect to blank. (auth)

**58** ATOMIC ABSORPTION DETERMINATION OF RUTHENIUM. Yudelevich, I. G.; Vilyugina, M. D. (Inst. of Inorganic Chemistry, Novosibirsk, USSR). Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Khim. Nauk; No. 9, 60-63(Jul 1973). (In Russian).

Atomic absorption spectrophotometry is critically evaluated as a method for the determination of ruthenium. With careful matrix compensation, reliable results can be obtained down to lower concentration limits of 0.5 mg/ml. Palladium, platinum, rhodium, iron, copper, and nickel interfere strongly with the determination of ruthenium in chloric acid solutions. Ionization interferences should be controlled by adding a large amount of lanthanum chloride (3%) to the samples and standards. (auth)

**59** QUANTITATIVE DETERMINATION OF ZIRCON BY INFRARED ABSORPTION SPECTRA. Plekhanova, E. A.; Lis, G. N.; Melekhova, T. F. (Inst. of Physical-Chemical Processing

**33** NEUTRON-CAPTURE GAMMA-RAY ACTIVATION ANALYSIS OF REFINED STEEL. Zwittlinger, H. (Oesterreichische Studiengesellschaft fuer Atomenergie, Seibersdorf, Austria). J. Radioanal. Chem.; 14: No. 1, 147-158(Mar 1973).

Nuclear-capture $\gamma$ activation analysis of the elements Cr, Mn, Fe, Co, Ni, and W in refined steel was carried out using a collimated reactor neutron beam and a Ge(Li) detector. A short description of the method, the detector system, electronics, shieldings and sample preparation is given. A correction of iron and chromium peak areas is necessary in the spectra of all samples, because of the scattering of neutrons into the detector system by the samples. This part of the background interference can be evaluated by means of the nuclear capture $\gamma$ of lead (7380 keV). (auth)

## Chemical and Spectral Procedures

*Refer also to abstracts 621, 845, 847, 878, 881, 2366, and 2383.*

**34** (ARH-2745) DIFFERENTIAL SPECTROPHOTOMETRIC DETERMINATION OF PLUTONIUM USING THE CARY MODEL 16 SPECTROPHOTOMETER. Winters, W. I. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Aug 1973. Contract AT(45-1)-2130. 50p. Dep. NTIS $5.45.

The application of a high-precision Cary Model 16 spectrophotometer to the differential spectrophotometric determination of plutonium(III) was investigated. The absorbances of plutonium(III) solutions were measured against colored glass filters at 560 nanometers. Selection of various instrument parameters and the determination of the best reference filter for the highest precision are discussed. Two sets of calibration points were analyzed. The absorbance for each set was measured once a day for three days. A statistical comparison between the three readings, the three least squares curves, and the two sets of calibration points are discussed. The standard deviation of the average reading about the line was ±0.0028 g/liter plutonium in the 11 to 15 g/liter plutonium range. Detailed procedures for standard preparation from plutonium nitrate and for operation of the Cary Model 16 are included. The advantages and disadvantages of the equipment and method are discussed and further experiments suggested. (auth)

**35** (CEA-R-4475) DETERMINATION OF IMPURITIES IN URANIUM–NIOBIUM (7.5%)–ZIRCONIUM (2.5%) ALLOY. Arragon, Y. (CEA Centre d'Etudes de Bruyeres-le Chatel, 92, Montrouge (France)). Oct 1973. 47p. (In French). Dep. NTIS (U.S. Sales Only) $4.50.

The determination of 11 impurities in uranium–niobium–zirconium alloys was studied. Elements of which the alloy is composed are considered and information is given on the determination of niobium by niobic acid precipitation. Selective elimination of the three components is discussed. Two liquid-liquid extractions are used. The niobium is separated by methylisobutylketone in a hydrochloric–hydrofluoric medium and the zirconium and uranium by tributyl phosphate in a nitric medium. The determination of trace elements using electrochemical methods is discussed. Anodic re-dissolution polarography or square wave polarography enabled six elements (cadmium, copper, lead, zinc, bismuth, and thallium) to be determined in a carbonate medium together with aluminium in tetraethylammonium perchlorate, molybdenum in nitric acid, ammonium nitrate, and tungsten in hydrochloric acid with added double sodium and potassium tartrate. Fluorine was determined using ionometric techniques with a specific electrode and carbon was titrated by conductometry after combustion of the sample in an oxygen current. (auth)

**36** (CONF-730525-, pp 261-272) TWO APPROACHES FOR THE ANALYSIS OF THE MASS SPECTRA OF ISOTOPICALLY ENRICHED NATURAL PRODUCTS. Buddenbaum, W. E.; Earl, B. S.; Daves, G. D. Jr. (Oregon Graduate Center, Beaverton). 1973.

From 1st international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

The increased accessibility of stable isotopes is stimulating many new and important applications in widely varied fields of biological, chemical, and medical research. Mass spectrometry has appeared as a highly promising analytical tool for these isotopes; however, to date, its application for detailed isotopic analysis of the multi-enriched molecules produced in these experiments has been limited in spite of the extremely numerous experimental data present in a single spectrum. Two new approaches for detailed isotopic analysis of mass spectral intensity data will be discussed. The first method will be illustrated using intensity data for mass spectral fragmentation ions of a biosynthetically $^{13}$C-enriched Sepedonin. (auth)

**37** (CONF-730525-, pp 291-298) QUANTITATIVE MEASUREMENTS OF ENDOGENOUS AND $^{2}$H-TRACER VARIANTS OF DRUGS AND METABOLITES USING A MULTIPLEXED GC/QUADRUPOLE MASS SPECTROMETER SYSTEM. Jenden, D. J.; Cho, A. K.; Silverman, R. W. (Univ. of California, Los Angeles). 1973.

From 1st international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

A description of a multiplexed quadrupole GC/MS system that was developed for quantitative isotope dilution methods of this type, and two applications that illustrate their sensitivity and versatility are presented. The first is an isotope dilution assay for amphetamine and the second is a procedure for the simultaneous measurement of endogenous and $^{2}$H-labeled tracer variants of choline and acetylcholine. (auth)

**38** (CONF-730525-, pp 452-459) DETERMINATION OF NITRIC OXIDE IN BLOOD BY ISOTOPE DILUTION ANALYSIS. Anbar, M.; Dyer, R. L.; St. John, G. A. (Stanford Research Inst., Menlo Park, CA). 1973.

From 1st international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

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Isotope dilution analysis using field ionization mass spectrometry was used for the determination of nitric oxide in blood. Blood exposed to a known amount of $^{15}$NO exchanges any bound $^{14}$NO with excess $^{15}$NO, resulting in an isotopic dilution of the latter. The precision of the method stands at +10%, which seems acceptable for epidemiological or physiological investigations. (JGB)

**39** (NBL-267, pp 6-12) EFFECT OF IMPURITIES ON THE NEW BRUNSWICK LABORATORY TITRIMETRIC METHOD OF DETERMINING URANIUM. II. Platinum Metals, Chloride, and Bromide. Scarborough, J. M.; Bodnar, L. Z. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

Ruthenium, palladium, osmium, iridium, and platinum cause serious positive errors in the determination of uranium by the NBL titrimetric method. Rhodium alone among the platinum metals does not cause any significant error. Chloride causes positive errors apparently not strictly related to the stoichiometric quantity present. In addition, chloride seriously affects the behavior of the platinum electrode. Bromide can cause either positive or negative errors depending upon the amount present. This fact suggests that there are two interfering processes occurring. One milligram or less of bromide can be tolerated. The elimination of their interferences is discussed. (DHM)

**40** (NBL-267, pp 13-16) EFFECT OF IMPURITIES ON THE NEW BRUNSWICK LABORATORY TITRIMETRIC METHOD OF DETERMINING URANIUM. III. Fluoride. Bodnar, L. Z.; Scarborough, J. M. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

Fluoride above certain concentrations was shown to interfere with the NBL titrimetric method for uranium. The interference can be eliminated by an evaporation step or by complexing prior to the determination of uranium. (auth)

**41** (NBL-267, pp 17-18) EFFECT OF IMPURITIES ON THE NEW BRUNSWICK LABORATORY TITRIMETRIC METHOD OF DETERMINING URANIUM. IV. Hydrogen Peroxide. Scarborough, J. M. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

The interference of hydrogen peroxide in the NBL titrimetric method of determining uranium was shown to be due to the depletion of the ferrous ion reductant in the procedure. (auth)

**42** (NBL-267, pp 19-21) ELIMINATION OF SOME INTERFERENCES IN THE NEW BRUNSWICK LABORATORY TITRIMETRIC URANIUM METHOD BY MEANS OF A COPPER COLUMN. Bodnar, L. Z.; Scarborough, J. M.; Lerner, M. W. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

The interference of mercury, platinum and palladium in the NBL titrimetric method for uranium can be eliminated by a copper column technique. (auth)

**43** (NBL-267, pp 22-28) APPLICATION OF THE RADIOMETER TITRATOR MODEL TTT2 TO THE NEW BRUNSWICK LABORATORY TITRIMETRIC METHOD OF DETERMINING URANIUM. Bodnar, L. Z.; Scarborough, J. M. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

The Radiometer Titrator TTT2, a commercially available instrument that automatically titrates a solution to a preselected potential or pH, was evaluated for its applicability to the NBL method of determining uranium. (auth)

**44** (NBL-267, pp 29-31) EVALUATION OF AN AUTOMATIC URANIUM ANALYZER BASED UPON CONSTANT CURRENT COULOMETRY: A PROGRESS REPORT. Goldbeck, C. G.; Lerner, M. W.; Peoples, G. E. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

Evaluation of the automatic uranium analyzer based upon the constant-current generation of vanadium(V) has revealed several modifications that were needed to improve the reliability of results. An unknown factor responsible for slightly negative errors still exists. (auth)

**45** (NBL-267, pp 32-34) DETERMINATION OF URANIUM IN URANIUM–THORIUM SOLUTIONS BY CONTROLLED-POTENTIAL COULOMETRY AT A MERCURY POOL ELECTRODE. Lewis, K. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

**46** (NBL-267, pp 35) CONTROLLED-POTENTIAL COULOMETRIC DETERMINATION OF URANIUM WITH A PLATINUM ELECTRODE AFTER REDUCTION WITH IRON(II) IN PHOSPHORIC ACID. Lewis, K.; Lerner, M. W. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

After reduction to uranium(IV) by the Davies and Gray procedure, uranium can be determined by controlled-potential coulometry with a platinum electrode by allowing it to react with iron(III) prior to the coulometry. Determinations of 5 to 10 mg of uranium show a relative standard deviation of within 0.1%.

**47** (NBL-267, pp 36-39) X-RAY SPECTROGRAPHIC DETERMINATION OF URANIUM IN LOW-GRADE SAMPLES BY A LITHIUM TETRABORATE FUSION TECHNIQUE: A PROGRESS REPORT. Busch, A. J.; Goldbeck, C. G. Sep 1973.

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A technique for quantitative determination of zircon by infrared absorption spectra was worked out. Results are given for quantitative determination of zircon when synthesizing it from oxides. (auth)

**60** X-RAY FLUORESCENCE ANALYSIS OF RARE EARTH ELEMENTS. Bonnevie-Svendsen, M.; Follo, A. (Inst. for Atomenergi, Kjeller, Norway). pp 87-107 of Analysis and Application of Rare Earth Materials. Michelsen, O. B. (ed.). Oslo; Universitetsforlaget (1973).

From NATO Advanced Study Institute; Kjeller, Norway (23 Aug 1972).

X-ray fluorescence analysis is used for the direct determination of rare earth elements in rock samples, minerals, rare earth concentrates, products and process solutions. Only a minimum of sample pretreatment is required. Solid samples are mostly powdered and measured as briquets. Liquid samples can be measured as received, but for larger series of process samples a filter technique is preferred. The x-ray spectra are much simpler than optical spectra, and experience shows that essentially interference-free first or second order lines can be found for most rare earth elements in practically all types of rare earth mixtures. X-ray fluorescence is a rapid and precise method, but careful precautions are required to avoid errors caused by general or selective absorption-enhancement effects. There is a variety of modes to correct for these effects. The use of internal standards, calibration curves, spike and dilution methods as well as cross-checking with other methods is discussed and illustrated by examples. (auth)

**61** TRACE ELEMENTS CHARACTERIZATION IN $Y_2O_3$ BY MASS SPECTROSCOPY AND ISOTOPIC DILUTION. Haaland, J.; Stijfhoorn, D. E. (Inst. for Atomenergi, Kjeller, Norway). pp 154-164 of Analysis and Application of Rare Earth Materials. Michelsen, O. B. (ed.). Oslo; Universitetsforlaget (1973).

From NATO Advanced Study Institute; Kjeller, Norway (23 Aug 1972).

Rare earth elements at concentrations down to 0.1 ppM were determined in pure yttrium oxides using isotopic dilution and the ATLAS CH4 single focussing instrument with a double rhenium filament ion source. The eight poly-isotopic elements were determined in one run after addition of a master-spike. Oxide peaks from the lighter elements were removed effectively by passing benzene through the source. The AEI MS 702 double focussing spark source mass spectrometer with photographic registration was used to give a general survey of the distribution of both RE and non-RE elements. The $Y_2O_3$ samples were mixed with 60% pure graphite to make them conducting and pressed into a pair of tiny electrodes. A series of spike isotopes were again mixed in for calibration. A simplified plate calibration procedure was used. The peaks of the spike isotopes served for quantitative determinations, either by isotopic dilution or by precalculated sensitivity factors for other elements. A background spectrum from carbon, yttrium carbide, etc. interferes in some cases with analysis lines. The general limit of determination is also in this case 0.1 ppM. (auth)

**62** TRACE LEVEL RARE EARTH DETERMINATION BY X-RAY EXCITED OPTICAL FLUORESCENCE SPECTROSCOPY. Fassel, V. A.; DeKalb, E. L.; D'Silva, A. P. (Ames Lab., IA). pp 109-122 of Analysis and Application of Rare Earth Materials. Michelsen, O. B. (ed.). Oslo; Universitetsforlaget (1973).

From NATO Advanced Study Institute; Kjeller, Norway (23 Aug 1972).

X-ray excited optical fluorescence (XEOF) has emerged during the past decade as a remarkably sensitive technique for the detection and quantitative determination of rare earth impurities in a variety of matrices. Various aspects of the method are reviewed. A selected number of applications of XEOF to the determination of residual rare earth impurities in fertile nuclear materials and in highly purified rare earth compounds are discussed. (auth)

**63** CATHODE-RAY-EXCITED EMISSION (CREE) SPECTROSCOPIC ANALYSIS OF TRACE RARE EARTHS. Larach, S. (RCA Labs., Princeton, NJ). pp 123-151 of Analysis and Application of Rare Earth Materials. Michelsen, O. B. (ed.). Oslo; Universitetsforlaget (1973).

From NATO Advanced Study Institute; Kjeller, Norway (23 Aug 1972).

Line emissions from f-f transitions of trace amounts of rare earths contained in a matrix are obtained by cathode-ray excitation. The distinctive energy of these emissions is utilized to detect the presence of such trace rare earths, and the intensity of the emission is proportional to the amount of rare earth present. This nondestructive method is applicable to the analysis of rare earths in any matrix which supports cathodoluminescence. Results are discussed for rare earths in yttrium oxide, gadolinium oxide, and zinc sulfide. In the case of thulium, comparisons are made with analytical results obtained with solid state mass spectrometry. Equipment required for CREE analysis is described, and specific examples are given. (auth)

**64** DETERMINATION OF TERBIUM AND DYSPROSIUM BY ATOMIC ABSORPTION SPECTROMETRY. Ishizuka, T.; Sunahara, H. (Government Industrial Research Inst., Nagoya, Japan). Anal. Chim. Acta; 66: No. 3, 343-349(Oct 1973).

The effects of several inorganic acids, metal ions, and alcohols were studied on the determination of terbium and dysprosium by atomic absorption spectrometry. The two metals were determined in the presence of yttria and in rare-earth oxides with satisfactory results. (auth)

**65** CONTRIBUTIONS TO THE ANALYSIS OF NUCLEAR RAW MATERIALS. IV. Korkisch, J.; Steffan, I. (Univ., Vienna). Mikrochim. Acta; No. 5, 651-663(1973). (In German).

A method is described for the determination of vanadium and molybdenum in minerals that contain uranium. After the acid or alkaline decomposition of the sample, the vanadium is first separated in the 6M hydrochloric acid decomposing solution from the molybdenum, iron, and uranium by employment of the strongly basic anion exchanger Dowex 1-X8 by elution with 6M hydrochloric acid and determined then in the evaporation residue of the eluate spectrophotometrically by means of a modified form of the phosphotungstic acid method. Thereupon the molybdenum which was adsorbed on the anion exchanger is selectively eluted with a mixture of 90 vol. % methanol and 10 vol. % hydrochloric acid and after evaporation of the eluate is determined spectrophotometrically by the thiocyanate method. The organic substances that originate in the exchange resin and are now present in the vanadium or molybdenum eluates, and which interfere in the spectrophotometric determinations of these elements, are decomposed oxidatively by means of aqua regia or concentrated nitric acid and thus rendered harmless. The findings obtained from analysis of ten minerals containing uranium exhibit excellent agreement. (auth)

**66** CONCERNING TITANOMETRY IN ALKALINE MEDIUM. II. Ruzicka, E. (Palacky Univ., Olomouc, Czech.). Mikrochim. Acta; No. 5, 823-828(1973). (In German).

When Ti(III) is used as a standard solution, possibilities were revealed for the determination of iodate, bromate, and periodate in ammoniacal medium. With the exception of periodate, the reduction proceeds as far as bromide or iodide. Septivalent iodine is reduced only to the positive univalent state. The reaction takes another course in the case of a relative deficiency of periodate in the presence of bromate or iodate. (auth)

**67** CATALYTIC THERMOMETRIC ENDPOINT INDICATION OF CHELATOMETRIC TITRATIONS BY MEANS OF OXIDATION REACTIONS OF ORGANIC COMPOUNDS WITH HYDROGEN PEROXIDE. Kiss, T. F. A. (Univ. Novi Sad, Yugoslavia). Mikrochim. Acta; No. 5, 847-852(1973). (In German).

The application of several oxidation reactions using hydrogen peroxide as exothermic indication reactions to catalytic thermometric end-point detection of chelatometric titrations is described. This time the oxidations of resorcinol and catechol, both catalyzed by copper(II), as well as the oxidations of hydroquinone and dimethyl-p-phenylenediamine, both catalyzed by copper(II) and iron(III), were used as indicator systems. The titrations of EDTA, DCTA and NTA with copper(II) and iron(III), the inverse titration of these metals, as well as the determination of a number of metal ions (alkaline earth metals, $Cu^{2+}$, $Ni^{2+}$, $Co^{2+}$, $Zn^{2+}$, $Sn^{2+}$, $Fe^{3+}$, $Al^{3+}$, $Cr^{3+}$, $Sb^{3+}$, $In^{3+}$, $Ga^{3+}$, and $Th^{4+}$) by back- and substitution titrations were developed. The ions mentioned can thus be determined in the milligram and in the microgram range with reasonable accuracy. (auth)

**68** RAPID SOLVENT EXTRACTION OF URANIUM(VI) WITH N-PHENYLBENZOHYDROXAMIC ACID. Shukla, J. P.; Agrawal, Y. K.; Bhatt, K. (Government Coll. of Science, Jabalpur, India). Separ. Sci.; 8: No. 3, 387-393(1973).

A rapid method for the simultaneous solvent extraction and spectrophotometric determination of macroamounts of hexavalent uranium with N-phenylbenzohydroxamic acid is described. The intense blood-red colored complex thus extracted from chloroform at pH ~ 4 absorbs at around 510 nm. A clean-cut separation from many commonly occurring metal ions is easily accomplished. Effects of acidity, reagent concentration, and diverse ions on the visible absorption of the extracted complex were also investigated. (auth)

**69** CYCLIC VOLTAMETRIC BEHAVIOR OF URANYL ION IN SULFURIC ACID SOLUTIONS. Application to Some Nuclear Materials Characterization. Casadio, S.; Lorenzini, L. (CNEN, Rome). Anal. Lett.; 6: No. 9, 809-820(1973).

U(VI) reduction at the mercury electrode in $H_2SO_4$ solutions was examined by cyclic voltametry. A diffusion coefficient, D, of $(5.30 \pm 0.08) \times 10^{-6}$ $cm^2/sec$ was obtained for the depolarizer at $25.0 \pm 0.2°C$ in 1N $K_2SO_4$ (pH = 2). In 1N $K_2SO_4$/1N $H_2SO_4$ systems the disproportionation of U(V) was found to occur with the constant rate of $K_d/[H^+] = 6.500 \pm 1.000\ M^{-2}sec^{-1}$. In 1M $H_2SO_4$ supporting electrolyte pure kinetic control was achieved over the range of scan rates and uranyl concentration (C) investigated, hence linear correlation between cathodic peak current and C (above $5 \times 10^{-6}$ M) was obtained. Strong complexing oxyanions, such as phosphate and pyrosulphate, do not interfere with the cathodic peak current. Rapid determination of O/U ratios in uranium oxides and of U in mixed U–Th materials were performed respectively in 1M $H_2SO_4$/1.5M $H_3PO_4$ and 1M $H_2SO_4$/0.2M $K_2S_2O_4$ supporting media, with a reproducibility of ± 1.3% standard deviation. (auth)

**70** EFFECTS OF PHYSICAL AND CHEMICAL AGENTS ON COMPETING AND TRANSFORMING-ABILITIES OF DNA IN BACILLUS SUBTILIS. Tanooka, H. (National Cancer Center, Tokyo); Makino, F. J. Radiat. Res.; 14: No. 1, 18-30(Mar 1973).

The ability of various DNA and biopolymers to compete with genetic marker-bearing DNA in the Bacillus subtilis transformation system was studied. Among tested polymers, only DNA exhibited the competing ability. Treatment of DNA with physical or chemical agents destroyed the competing ability. The competing ability of the treated DNA was compared with other abilities of the same DNA, i.e., transforming ability on another marker and ability to compete with $^3H$-labeled marker DNA at incorporation into host cells. A parallelism was found between the transformation-competing ability and the incorporation-competing ability, while a parallelism was not necessarily held between the competing ability and the transforming ability depending upon the agent used. From the modes of actions on these abilities of DNA, the agents were classified in two major groups, (I) those that inactivate the transforming ability of DNA, but exert little effect on its competing ability (e.g., ionizing radiation exerting indirect action, uv, nitrogen mustard, nitrous acid, 4HAQ0, DNase I, sonication) and (II) those that inactivate the transforming ability of DNA as well as its competing ability (e.g., ionizing radiation exerting direct action, shearing). The nature of molecular damages caused by these agents was discussed. (auth)

**71** INTEGRATED GAS CHROMATOGRAPHY-MASS SPECTROMETRY. Ryhage, R. (Kungliga Karolinska Mediko-Kirurgiska Institutet, Stockholm). Quart. Rev. Biophys.; 6: No. 3, 311-335 (Aug 1973).

A review of the technique covering recent improvements, the recording of gas chromatography diagrams and mass spectra, and applications and computerisation of gas chromatography–mass spectroscopy is presented. (UK)

**72** POLAROGRAPHY OF METAL IONS IN HEXAMETHYLPHOSPHORAMIDE MEDIUM. Luehrs, D. C.; Leddy, D. G. (Michigan Technological Univ., Houghton). J. Electroanal. Chem.; 41: No. 1, 113-117(1973).

Hexamethylphosphoramide (I) was investigated as a nonaqueous solvent for polarographic analysis. After purification by fractional distillation and recrystallization, I had a negligible background current over the range –0.8 V to –2.0 V (vs. the S.C.E.), and was successfully used in analyses for $K^+$, $Rb^+$, $Cs^+$, $Tl^+$, $Cu^{2+}$, $Cd^{2+}$, $Pb^{2+}$, and halide ions. However, I that has been stored for > 3 days (even under N) requires re-purification. (Anal. Abstr.)

**73** PROVISIONAL METHOD FOR THE DETERMINATION OF ZIRCONIUM. J. Soc. Leather Trades Chem.; 57: No. 2, 46-47(1973).

A method is described for the determination of Zr in leather. Ignite the sample of leather, treat the ash with HF to remove $SiO_2$ and then fuse the residue with $Na_2CO_3$–$K_2CO_3$–$Na_2B_4O_7$ (1:1:1). Place the cooled melt in $H_2O$, filter, dissolve the precipitated zirconium oxide hydrate in $H_2SO_4$ and titrate with EDTA solution, using xylenol orange as indicator. (Anal. Abstr.)

**74** DETERMINATION OF VARIOUS ELEMENTS BY ATOMIC ABSORPTION AFTER EXTRACTION WITH PYRROLIDINE-1 CARBODITHIOIC ACID AND ISOBUTYL METHYL KETONE. Broncano, A.; Gomez Coedo, A. (Cenim, Madrid). Rev. Met. (Madrid); 8: No. 6, 433-437(1972). (In Spanish).

Atomic absorption spectroscopy was used for the determination of impurities in aluminum. To establish which elements could be extracted satisfactorily from aqueous medium with the named reagents, solutions containing the individual elements (2 to 200 ppM), adjusted to pH values in the range 0.3 to 10, were treated with pyrrolidine-1-carbodithioic acid and, after 5 min, shaken with isobutyl methyl ketone. The residual aqueous solution was shaken with more of each reagent, and the organic phases were combined. For the atomic absorption, the elements were re-extracted into $HNO_3$ (1:2) and determined with use of an air–acetylene or $N_2O$–acetylene flame. The results showed that Bi, Cd, Cu, Fe, Pb, Ni, V, Zn, and Sb were extracted quantitatively (at the appropriate pH); Co, Mn, and Mo were extracted only partially; and Sn and Al were hardly extracted at all. (Anal. Abstr.)

**75** DIFFERENCE-PHOTOMETRIC DETERMINATION, WITH STILBAZOKHIMDU, OF LANTHANOIDS OF THE YTTRIUM SUBGROUP IN SEMICONDUCTOR MATERIALS. Akhmedli, M. K.; Basargin, N. N.; Islamov, Sh. U. Uch. Zap. Azerb. Gos. Univ., Ser. Khim. Nauk; No. 1, 14-17(1972). (In Russian).

The method described is for determining Gd or Yb in the alloys $GdInS_3$, $GdGaS_3$, $InYbSe_3$ and $GaYbSe_3$; it is based on the formation of complexes of the lanthanoids with 4,4′-bis-{7-[bis-(carboxymethyl)aminomethyl]-1,8-dihydroxy-3,6-disulpho-2-naphthylazo} stilbene-2,2′-disulphonic acid (stilbazokhimdu). Dissolve the sample in $HClO_4$, neutralize the solution with aqueous $NH_3$, then add further aqueous $NH_3$ until precipitation of hydroxides is complete. Collect the precipitate, dissolve it in HCl, and precipitate the lanthanoid as its oxalate. Dissolve the precipitate in the minimum amount of $HNO_3$, dilute with $H_2O$, and add stilbazokhimdu; dilute with buffer solution, and measure the extinction at 660 nm against that of a solution containing a known amount of lanthanoid. The error is within ±1%. (Referativnyi Zh.)

**76** TECHNIQUES FOR THE MUTUAL SEPARATION OF THE LANTHANIDES IN ANALYTICAL CHEMISTRY. Das, H. A.; van Ooyen, J. (Reactor Centrum Nederlands, Petten). pp 25-38 of Analysis and Application of Rare Earth Materials. Michelsen, O. B. (ed.). Oslo; Universitetsforlaget (1973).

From NATO Advanced Study Institute; Kjeller, Norway (23 Aug 1972).

The separation of the rare earths from other, possibly interfering, elements by liquid–liquid extraction is outlined and the spectrophotometric analysis of the total rare earths briefly described. The mutual separation of the rare earths by cation exchange is discussed and anion exchange methods are also briefly treated. The applications of both cation and anion techniques in activation analysis are described. Separation by high-pressure cation exchange is then presented and the equipment used described. Finally separation by extraction and electrophoresis on paper strips is discussed. (NO)

**77** FLAME AND PLASMA ATOMIC ABSORPTION, EMISSION, AND FLUORESCENCE SPECTROSCOPY OF THE RARE EARTH ELEMENTS. Fassel, V. A.; Knisely, R. N.; Butler, C. C. (Ames Lab., IA). pp 71-86 of Analysis and Application of Rare Earth Materials. Michelsen, O. B. (ed.). Oslo; Universitetsforlaget (1973).

From NATO Advanced Study Institute; Kjeller, Norway (23 Aug 1972).

In comparison with the very complex spectra emitted by the rare earth elements in arc or spark discharges, their corresponding flame emission spectra are relatively simple. Historically, the first analytical applications of flame emission spectra utilized observations on the rare earth monoxide band systems, which constitute the principal spectral features in the spectra emitted by non-reducing flames. Because of the spectral overlap of the band systems, their analytical utility was rather limited. The observation that fuel-rich $O_2$–$C_2H_2$ or $N_2O$–$C_2H_2$ flames provided a striking increase in the atomization efficiency, and hence a greater free-atom population in the flames, greatly broadened the scope of application of flame spectroscopy. The enhancement factors in the line emission spectra achieved by simply changing the stoichiometry of either $O_2$–$C_2H_2$ or $N_2O$–$C_2H_2$ flames are typically several orders of magnitude. Flame emission generally exhibits greater powers of detection than atomic absorption measurements by factors ranging from 2 to 80. As a consequence, flame emission spectroscopic techniques have found a wider application, at least in the Ames Laboratory, in the analysis of rare earth mixtures and in the determination of low concentrations of the rare earth elements. Although the ultimate potential of electrically generated "flame-like" plasmas has not been evaluated, the preliminary results suggest that these plasmas may replace combustion flames as excitation sources for the analysis of rare earth mixtures. (auth)

**78** EMISSION SPECTROSCOPY FOR RARE EARTH ANALYSES, AND FOR THE DETERMINATION OF IMPURITIES IN RARE EARTH MATERIALS. DeKalb, E. L. (Ames Lab., IA). pp 61-70 of Analysis and Application of Rare Earth Materials. Michelsen, O. B. (ed.). Oslo; Universitetsforlaget (1973).

From NATO Advanced Study Institute; Kjeller, Norway (23 Aug 1972).

Emission spectroscopy is the primary and most powerful analytical tool for the chemical analysis of rare earth materials, and for the determination of rare earth impurities in other materials. However, many rare earth elements have a complex emission spectrum, so that spectral equipment and analytical procedures must be selected with care. Rare earth analyses can be classified into four broad categories: - the determination of rare earths in a "pure" rare earth; the determination of other impurities in a rare earth; the determination of rare earths in a mixture of various rare earths; and the determination of rare earth impurities in other materials. Each of these four types of analysis presents the spectroscopist with unique problems which may be solved in several ways. The present state-of-the-art, as measured by detection limits, is reviewed for the first two categories. (auth)

79 ANION EXCHANGE CONCENTRATION OF RARE EARTH IMPURITIES IN RARE EARTH MATERIALS FOR ANALYTICAL PURPOSES. Molnar, F. (Joint Inst. for Nuclear Research, Dubna, USSR). pp 55-59 of Analysis and Application of Rare Earth Materials. Michelsen, O. B. (ed.). Oslo; Universitetsforlaget (1973).

From NATO Advanced Study Institute; Kjeller, Norway (23 Aug 1972).

For a total analysis of rare earth impurities in very pure rare earth matrix elements it is necessary to concentrate these impurities before their analysis. For this purpose an anion exchange method, based on the chromatographic separation of the impurities and the matrix element using aqueous methanol solutions of ammonium nitrate as eluents, was developed. It was found that from the cerium sub-group matrices all rare earth impurities, except the heavier adjacent one, can be separated. From the yttrium sub-group matrices only cerium sub-group impurities can be separated, depending on the atomic number of the matrix element of terbium and dysprosium. The enrichment factor for this concentration procedure is about $10^6$. The concentrated impurities can be processed further as required by the method chosen for their analytical determination. (auth)

80 DETERMINATION OF RARE EARTH IMPURITIES IN PURE RARE EARTHS BY MEANS OF EXTRACTION CHROMATOGRAPHY. Herrmann, E. (Joint Inst. for Nuclear Research, Dubna, USSR). pp 39-53 of Analysis and Application of Rare Earth Materials. Michelsen, O. B. (ed.). Oslo; Universitetsforlaget (1973).

From NATO Advanced Study Institute; Kjeller, Norway (23 Aug 1972).

Determination of rare earth impurities in very pure rare earth materials is frequently difficult without a preconcentration of the tracers. The use of extraction chromatography with undiluted di(2-ethylhexyl) phosphoric acid (HDEHP) as a stationary phase for the concentration of tracers with lower atomic number relative to that of the macro element was investigated. Enrichment factors of about $10^6$ and yields of more than 80% were obtained with excellent reproducibility when $A_{macro}/D_{micro} \geq 1.5$. $D_{micro}$ is the partition coefficient of the trace impurity, $A_{macro}$ is the position of the front, normalized to the unit HDEHP volume on the column, and depends on the loading B (expressed in %) of the column with rare earth ions and on the partition coefficient E of the macro element measured in trace concentration. This dependence can be expressed by the empirical equation: $\lg A = \lg E - 0.036B - 0.15$. The influence of macro amounts of a given rare earth element on the partition behavior of other lanthanides present in trace concentrations was also investigated. The amount of an individual rare earth in the concentrate was determined by optical spectrometry, neutron activation analysis, spectrophotometry with arsenazo III, or complexometric titration with DTPA. In the last two cases it is necessary to use a preliminary separation of the components in the concentrate. This was done either by the cation exchange -$\alpha$-hydroxyisobutyrate method or by means of extraction chromatography using a HDEHP microcolumn. The standard deviation of the determinations depends only on the analytical procedure, the preconcentration being of negligible importance in this respect. (auth)

81 OSCILLOPOLAROGRAPHIC STUDY OF THE ANODIC REDUCTION OF URANYL IONS IN PHOSPHORIC ACID SOLUTIONS OF DIFFERENT CONCENTRATIONS. Kurbatov, D. I.; Nikitina, G. A. Tr. Inst. Khim., Akad. Nauk SSSR, Ural. Filial; No. 17, 183-189(1970). (In Russian).

It was shown that hexavalent uranium in phosphoric acid solution with concentration of phosphoric acid 90% and lower is reduced irreversibly with participation of one electron. During the reaction the peaks on the oscillopolarograph were clearly evident and can be used for the polarographic determination of uranium. In the solution $H_3PO_4:H_2O = 1:9$ (by volume) reversibility of the process was observed. The velocity constants and the free energy of activation for the electron reduction process of U(VI) were calculated for solutions with the composition $H_3PO_4:H_2O = 4:1$ (by volume). (tr-auth)

82 SEPARATION OF PLATINUM METALS USING THE RING-OVEN TECHNIQUE. Agrawal, B. K.; Ghose, A. K.; Agarwala, B. V. (Univ. of Allahabad, India). Separ. Sci.; 8: No. 3, 413-417(1973).

A scheme was developed for the qualitative separation of the six platinum metals from a drop of mixture by using the ring-oven technique. Osmium(VIII), palladium(II), ruthenium(III), rhodium(III), iridium(III), and platinum(IV) were transferred one by one to the ring zone by washing, respectively, with acetic anhydride, acetone, dimethylformamide-benzene mixture (1:3 v/v), methanol, dimethylformamide, and nitric acid (0.5 N). The rings obtained were developed by Alizarin Red S (Os); 1-(2-pyridylazo)-2-napthol (Pd); acidic solution of rubeanic acid (Ru); stannous chloride–potassium iodide (Rh and Pt); and benzidine in acetic acid after fuming the paper with bromine (Ir). The time required for the separation is not more than 45 min. (auth)

83 USES OF COMPLEXES IN KINETIC METHODS OF ANALYTICAL CHEMISTRY. Kopanica, M.; Stara, V. (Inst. of Physical Chemistry and Electrochemistry, Prague). Chem. Listy; 67: No. 9, 952-974(1973). (In Czech).

The article gives a review of the use of complexes and complexing agents in kinetic methods of analytical chemistry. Dissociation constants for complexes of the following metals are tabulated: Y, Sr, Ce, Pr, Nd, Sm, Eu, Ga, Tb, Dy, Th, Ho, Er, Tm, Yb, Sc, and Lu. (JGB)

84 SCANDIUM, YTTRIUM, AND LANTHANUM. Vickery, R. C. pp 329-353 of Comprehensive Inorganic Chemistry. Volume 3. Trotman-Dickenson, A. F. (ed.). Oxford; Pergamon Press Ltd. (1973).

Scandium, yttrium, and lanthanum are discussed from the standpoint of discovery and history, occurrence and distribution, production and industrial uses, metals preparation, isotopes, physical properties, chemical properties, compounds, complexes, and methods of analysis. (44 references) (JGB)

### *Radiometric and Radiochemical Procedures*

*Refer also to abstracts 153, 465, 472, 500, and 905.*

85 (COO-3563-8) PROCEDURE FOR ANALYSIS OF AMERICIUM IN MARINE ENVIRONMENTAL SAMPLES. Bojanowski, R.; Livingston, H. D.; Schneider, D. L.; Mann, D. R. (Woods Hole Oceanographic Institution, Mass. (USA)). 1973. 13p. Dep. NTIS $3.00.

A method is described for the measurement of americium in marine environmental samples. Some data are presented to show the ion exchange, $\alpha$-spectrometric method is capable of acceptable accuracy and precision. An extensive series of notes discusses the rationale for various steps in the procedure. (auth)

86 (COO-3563-15) QUALITY CONTROL IN RADIOCHEMICAL ANALYSIS. Harley, J. H.; Volchok, H. I. (USAEC Health and Safety Lab., New York; Woods Hole Oceanographic Institution, Mass. (USA)). 1972. 8p. Dep. NTIS $3.00.

An ideal system of quality control in radiochemical analysis is described and some data relating to analysis of seawater are presented. Several basic factors which affect the quality of a radiochemical analysis are: the use of proper standards for calibration; the use of proper counter efficiencies and backgrounds; the proper determination of radiochemical recovery; correction of results for analytical blank; and the continual checking of the performance of the overall system for accuracy and precision. (DHM)

87 (DP-MS-73-42) APPLICATION OF CLEAN ROOM OPERATIONS TO LOW-LEVEL CHEMICAL ANALYSIS. Boni, A. L. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). [nd]. Contract AT(07-2)-1. 21p. (CONF-731011-2). Dep. NTIS $3.25.

From 17th conference on analytical chemistry in nuclear technology; Gatlinburg, Tennessee USA (23 Oct 1973).

Sample contamination is a serious problem in obtaining valid analytical measurements at the low levels (ppB) of pollutant detection required today. Ordinary laboratory air may contain sufficient quantities of the element or compound of interest to alter significantly the true concentration. Contamination from direct contact with the sample through preparation, laboratory equipment, and reagents will also introduce additional errors in the accuracy of the measurement. Clean room equipment and methods adapted to ultra low-level radionuclide measurements are being applied at the Savannah River Laboratory to measure trace industrial chemicals in plant effluents and the surrounding environment. Laboratory air cleanliness is maintained by modular room design and high efficiency filtration systems. Contamination introduced by personnel is reduced by access control and clothing requirements. Dust accumulation is eliminated by ample space for equipment arrangement, "clean" benches, and continual housekeeping procedures. Reagents are checked for purity and discarded or repurified as needed. Sample packaging and containment methods used in sample preparation reduce contamination from normal handling operations. Analytical methods are also carefully selected to minimize contamination from excessive sample treatment. (auth)

**88** (NBL-267, pp 40-50) NONDESTRUCTIVE ANALYSIS OF LOW-GRADE URANIUM SAMPLES BY A PASSIVE GAMMA-RAY TECHNIQUE. Hagenauer, R. C.; Zyskowski, C. L.; Nelson, L. C. Jr. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

Nondestructive analysis of low-grade uranium samples was carried out by $\gamma$ spectrometry. Correction for self-absorption was made by a $^{169}$Yb technique. The results obtained for a number of analytical samples were compared to the chemical results. (auth)

**89** (NBL-267, pp 51-55) DETERMINATION OF URANIUM-235 BY A DELAYED NEUTRON COUNTING TECHNIQUE. Hagenauer, R. C.; Zyskowski, C. L.; Nelson, L. C. Jr. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

Determination of $^{235}$U in uranium dioxide–thorium dioxide mixtures and pyrocarbon- and silicon carbide-coated uranium–thorium carbide fuel beads was carried out by bombarding with thermal neutrons and counting the delayed neutrons arising from fission of the $^{235}$U. The precision and accuracy of some results are given. (auth)

**90** (UCRL-51422) FISCAL YEAR 1973 SUMMARY REPORT FOR THE USAEC DIVISION OF APPLIED TECHNOLOGY: ENVIRONMENTAL ANALYSIS. Odell, B. N. (ed.) (California Univ., Livermore. Lawrence Livermore Lab.). 5 Jul 1973. Contract W-7405-Eng-48. 19p. Dep. NTIS $4.00.

Separate abstracts were prepared for the four sections of the report. (DHM)

*For abstracts of individual sections see: 91, 153, 154, and 458.*

**91** (UCRL-51422, pp 7-9) ANALYSIS OF MARINE SEDIMENT. Cate, J. L. Jr.; Pickles, W. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Jul 1973.

In fiscal year 1973 summary report for the USAEC Division of Applied Technology: environmental analysis.

An x-ray fluorescence method for determining eleven elements (Ca, Ti, Cr, Fe, Cu, Zn, Pb, Br, Rb, Sr, and Zr) in marine sediment is described. The method presented is qualitative, but quantitative analysis to an accuracy of ±15% and with sensitivity of 1 ppM for most elements of $Z > 16$ should be available in the near future. (DHM)

**92** MEASUREMENT OF $^{133}$Xe ACTIVITY IN BLOOD SAMPLED IN PLASTIC AND GLASS SYRINGES. Strandell, T. (Santo Tomes Univ., Manila); Lindbergh, P. Scand. J. Clin. Lab. Invest.; 32: No. 1, 89-92(Aug 1973).

Samples of $^{133}$Xe in saline and blood were measured in 2-ml syringes of plastic and glass with different detectors. Good reproducibility with a coefficient of variation of 2% and good accuracy under varying conditions were obtained with a well scintillator with side hole and by a flat end scintillator with 6 cm distance to the sample. Despite the high uptake of xenon in the walls of the plastic syringes and their significant loss of activity of about 0.5% per hour, they were for other reasons preferred to glass syringes. (auth)

**93** METHOD OF MEASURING CONCENTRATION OF ALPHA RADIOACTIVE ISOTOPES IN AIR BY MEANS OF TWO ELECTROFILTERS. Jagielak, J.; Piatkowski, A. Nukleonika; 18: No. 7, 325-332(1973). (In Polish).

A method for measuring the concentrations of $\alpha$ isotopes occurring in the air in the form of dusts is described that consists of the application of two identical electrofilters placed one upon the other, this allows for the numerical evaluation of concentration without any knowledge of the effective coefficient of collecting dusts. The recommended method was utilized in measuring the concentration of natural isotopes in the atmospheric air. (auth)

**94** SPECTROPHOTOMETRIC STUDIES ON MOLYBDENUM(VI) REACTION WITH HYDROXYLAMINE AND 4-(THIAZOLYLAZO)RESORCINOL (TAR). Determination of Molybdenum. Szczygielska, M.; Kasiura, K. (Inst. of General Chemistry and Inorganic Tech., Warsaw). Chem. Anal. (Warsaw); 18: No. 4, 799-806(1973). (In Polish).

In the presence of hydroxylamine molybdenum(VI) forms with TAR a complex of MO:TAR = 1:1 composition. In the optimum range pH 4.5 to 5.7 the molar absorption coefficient of the complex is $2.94 \times 10^4$ at 530 nm and its conditional stability constant is $4.4 \times 10^5$. The method was used to determine molybdenum in copper ores after an initial separation with $\alpha$-benzoinoxime in sodium tungstate. (auth)

**95** URANIUM CONTENTS IN MINERALS BY FISSION TRACK METHOD. Nagpal, M. K. (Kruruksehetra Univ., India); Nagpaul, K. K.; Mehta, P. P. Pure Appl. Geophys.; 102: No. 1, 153-160(1973).

Uranium concentration in feldspar, pyroxene, and carbonate groups of minerals was studied by using the induced fission track technique. Fractions of homogeneously and heterogeneously distributed uranium were estimated by differential counting. The suitability of these minerals for fission track geochronology is discussed. (auth)

**96** DETERMINATION OF ISOTOPIC COMPOSITION OF WATER IN PRIMARY CIRCUIT BY THE CHROMATOGRAPHIC GROUP SEPARATION METHOD. Moskvin, L. N.; Miroshnikov, V. S.; Mel'nikov, V. A.; Slutskii, G. K.; Leont'ev, G. G. At. Energ. (USSR); 35: No. 2, 83-88(Aug 1973). (In Russian).

For rapid analysis of fission products in water of nuclear reactor primary circuits, which is necessary in checking hermeticity of fuel jackets, a method is proposed for the separation of elements of the mixture on a system of specific absorbers: trioctylamine, HDEHP, ammonium phosphomolybdate, anion exchange resin AB-17 and cation exchange resin KY-2. The respective extractants and ion exchange materials are coated on porous teflon pellets, which have small resistance. The proposed method was tested on primary circuit water of the BBP-M reactor. From the results of $\gamma$-spectrometric analysis of individual pellets, the following isotopes were identified and the content determined: $^{131}$I, $^{132}$I, $^{133}$I, $^{135}$I, $^{134}$Cs, $^{137}$Cs, $^{141}$Ce, $^{143}$Ce, $^{91}$Sr, $^{139}$Ba, $^{140}$Ba, $^{140}$La, $^{99}$Mo. (auth)

**97** GENERAL EXPERIENCE IN THE ROUTINE DETERMINATION OF $^{3}$H AND $^{14}$C BY LIQUID SCINTILLATION SPECTROMETRY. Effort for Increased Precision. Jordan, P.; Buechler, E.; May, K. (Eidgenoessische Technische Hochschule, Zurich). J. Radioanal. Chem.; 14: No. 1, 71-85(Mar 1973). (In German).

Experience accumulated in several years of routine work on liquid scintillation counting is presented, together with an analysis of the main sources of error and the mention of some means to reduce them. A precise method based on comparing analytical samples with known standards is described. (auth)

**98** CALIBRATION OF ALKYL-SUBSTITUTED FLUOROCYCLOPROPANES ON GAS CHROMATOGRAPHIC COLUMNS BY RADIOACTIVE TRACER TECHNIQUES. Min, B. K.; Daniel, S. H.; Tang, Y. N. (Texas A and M Univ., College Station). J. Radioanal. Chem.; 14: No. 1, 29-35(Mar 1973).

A new method utilizing a radiogas chromatographic system, for the calibration of various gas chromatographic columns with less than $10^{-12}$ M of tritium-labelled samples is described. The minimum detectable level of $^{3}$H, $^{38}$Cl, $^{18}$F, $^{80m}$Br, $^{82}$Br, $^{35}$S, and $^{14}$C labelled compounds employed for column calibration is discussed. In addition, the relative retention times of nine previously unpublished alkyl-substituted fluorocyclopropanes on five gas chromatographic columns are given. (auth)

**99** DETERMINATION OF $^{237}$Np IN URINE BY REVERSED-PHASE PARTITION CHROMATOGRAPHY. Santori, G.; Testa, C. (CNEN, Rome). J. Radioanal. Chem.; 14: No. 1, 37-43(Mar 1973).

A sensitive, rapid and selective method for the determination of $^{237}$Np in urine is described. Neptunium(IV) is isolated by batch-extraction with a slurry of Microthene-710 (microporous polyethylene) supporting a cyclohexane solution of tri-n-octylphosphine oxide, the slurry is transferred into a column and neptunium eluted by oxidation to Np(V) with a mixture of $HCl + Cl_2$. After electroplating on a stainless steel disc, neptunium is counted with a solid-state alpha-detector. The final recovery is 83.2%; the decontamination factors are sufficiently high and the sensitivity limit is suitable for radiotoxicological purposes. (auth)

**100** DETERMINATION OF FISSION PRODUCTS IN IRRADIATED URANIUM BY ELECTROPHORETIC FOCUSSING OF IONS. Pauwels, M.; Gijbels, R.; Hoste, J. (Univ., Ghent). J. Radioanal. Chem.; 14: No. 1, 5-18(Mar 1973).

Electrophoretic focussing of ions was applied to the separation of fission products present in solutions of nuclear uranium fuel irradiated in various European reactors. By combining two separation methods, all the long-lived fission products could be determined individually and quantitatively by counting with a NaI(Tl) and a GM detector of known detection efficiency. Radiography and autoradiography were used for semi-quantitative purposes. The concentrations of $^{235}U$ and $^{238}U$ were determined from a short post-irradiation of the fuel solution and counting of $^{140}Ba$ - $^{140}La$ and $^{239}Np$, respectively. An iterative calculus method is presented which allows calculation of the irradiation history of the fuel solution from the above analyses without any a priori knowledge. (auth)

**101** HIGH ENERGY ELECTRON IMPACT IONIZATION FOR ELEMENTAL ANALYSIS BY ENERGY DISPERSIVE X-RAY SPECTROMETRY. Colle, R. (Rensselaer, Polytechnic Inst., Troy, NY); Preiss, L.; Li-Scholz, A.; Scholz, W. J. Radioanal. Chem.; 14: No. 1, 87-103(Mar 1973).

A method was demonstrated in which the emission of characteristic x-rays following impact ionization by electrons of several MeV energy is used for quantitative elemental analysis. Because of the unique properties of MeV electrons with respect to their x-ray production yield and range in solids, the method has comparable sensitivity over a wide range of elements and relatively less stringent sample preparation requirements. By using energy dispersive techniques to detect the x-rays, a simultaneous determination of the weight fraction of the elements in an unknown sample is possible from a procedure based entirely on empirically determined relative x-ray yields. The method was tested by analyzing three standard metal alloy samples obtained from the National Bureau of Standards. Elements reaging from iron (Z = 26) to lead (Z = 82) with concentrations from 0.06% to 88% were quantitatively determined. In general, good approximate agreement was found with the reported assays even for the minor constituents. (auth)

**102** ANALYTICAL CAPABILITIES OF X-RAY EMISSION INDUCED IN HEAVY ELEMENTS BY HIGH-ENERGY PROTONS AND ALPHA-PARTICLES. Deconninck, G.; Gondrand, J. C.; Merchez, F.; Longequeue, N. (Univ., Namur, Belg.). J. Radioanal. Chem.; 14: No. 1, 183-188(Mar 1973).

The possibility of using high-energy ion beams for analytical purposes is explored. The most promising field is the identification of medium-weight elements by detection of K x-rays following alpha-particle and proton bombardment, where a sensitivity well below 1 ppM was predicted. In the case of heavy elements, interferences are possible because of competition of nuclear reactions. In the case of rare earths, the method is interference free, quantities of 0.1 mg/cm$^2$ can be determined. (auth)

**103** SOME ASPECTS OF DEVELOPING RADIOMETRIC ANALYSIS AND DETECTION METHODS. Koch, H. (Zentralinstitut fuer Isotopen- und Strahlenforschung, Leipzig). Isotopenpraxis; 9: No. 7, 233-238(Jul 1973). (In German).

During the past decennary, the use of quantum and particle radiation for analyzing matter distribution and composition has been extended to a considerable degree. Possible features of future demands to be met by such analysis methods, which result from modern research and development work, are shown, and possible uses are discussed together with the prospect of development of special techniques. Possibilities of total-view display, scanning techniques, and investigation of the surface of extremely thin layers are discussed as well as problems of structure analysis, and chemical bonds or bond configuration. (auth)

**104** USE OF THE DOUBLE-LABELING METHOD TO DETERMINE SILVER AND SELENIUM DISTRIBUTION IN THE PRODUCTS OF ELECTROLYTIC COPPER REFINING. Schulz, U.; Beyer, H. Isotopenpraxis; 9: No. 6, 193-197(Jun 1973). (In German).

Determination of the distribution of the interacting accompanying elements silver and selenium in the products of electrolytic copper refining requires an analyzing method, which apart from high sensitivity and reasonable expenditure of time offers their separate detection. This demand is met by the use of the radioactive isotopes $^{110m}Ag$ and $^{75}Se$, with separate detection being provided by gamma spectroscopy. The measuring methods are described together with the plotted energy spectra, and the derived concentration calculations are indicated. (auth)

## *Separation Procedures*

*Refer also to abstracts 201, 1666, 2359, and 2387.*

**105** FROTHLESS ION FLOTATION OF SOME RARE EARTH ELEMENTS. Szeglowski, Z.; Bitner-Jankowska, M.; Mikulski, J. (Inst. of Nuclear Physics, Krakow). Nukleonika; 18: No. 7, 299-306(1973).

Investigations on frothless ion flotation of europium, thulium, and ytterbium in the form of microcolloidal hydroxides from aqueous ammonium chloride solutions, and also in the form of anionic complexes with citric acid, as a function of flotation time, hydrogen ions, $NH_4Cl$, and citric acid concentrations were carried out. Anionic and cationic detergents sodium tetradecyl sulphate and cetylpyridinium bromide were used as the collectors. Isooctyl alcohol covering the surfaces of the floated solutions was the froth destructing agent and the solvent of the floated complexes. The results of the investigations show that the rare earth elements float in the form of microcolloidal hydrolysis products with the aid of anionic collectors with the maximum recovery at about pH 5. The recovery by flotoextraction strongly decreases with a rise of $NH_4Cl$ concentration and decreases also with increasing flotation time above some optimum. Citrate complexes of Eu, Tm, and Yb float in the alkaline medium with the aid of cationic collectors, reaching a maximum recovery at pH of about 10.5. The recovery by flotoextraction decreases with an increase of ammonium citrate concentration. Measurements of surface tensions of the floated solutions were carried out as a function of cetylpyridinium bromide concentration in order to correlate the flotation recovery with the adsorption of the collector at air-solution interface. (auth)

**106** FROTHLESS ION FLOTATION OF SOME TRIVALENT ACTINIDES. Szeglowski, Z.; Bittner-Jankowska, M.; Mikulski, J.; Machej, T. (Inst. of Nuclear Physics, Krakow). Nukleonika; 18: No. 7, 307-313(1973).

Frothless ion flotation of americium in the form of anionic complexes with citric acid, with the aid of the cationic collector (cetylpyridynium bromide), was studied as a function of citric acid concentration, flotation time, and hydrogen ion concentration. Flotation of microcolloidal americium hydroxides from aqueous solutions as a function of hydrogen ion concentration was also studied using the anionic collector sodium tetradecyl sulphate. Trivalent actinides behave similarly to the rare earth elements. The microcolloidal hydroxides float with anionic detergents as the collectors with the maximum recovery at pH of about 5. It was shown that the americium recovery by ion flotation decreases linearly with an increase of ammonium citrate concentration. Similarly, the extraction of americium with solutions of cetylpyridinium bromide in isooctyl alcohol decreases with a rise of ammonium citrate concentration in the aqueous phase, at constant pH equal to about 10.5. The experiments show that the equilibrium between the citrate complexes of americium shifts toward electrically neutral complexes which do not undergo ion exchange with the extraction agent used. Experiments on flotoextraction of anionic complexes of Am and Cm with nitrate ions were also carried out in a wide range of lithium nitrate concentrations in 0.01 N $HNO_3$. The recovery of Am and Cm by ion flotoextraction increases with the increase of $LiNO_3$ concentration. (auth)

**107** SPECTROPHOTOMETRIC STUDY AND EXTRACTION OF NIOBIUM(V) COMPLEXES WITH CATECHOL AND ITS DERIVATIVES AS ION-PAIRS WITH QUATERNARY AMMONIUM IONS. Application to the Separation of Niobium from Other Refractory Metal Ions. Nardillo, A. M.; Catoggio, J. A. (Univ. Nacional, La Plata). Anal. Chim. Acta; 66: No. 3, 359-376 (Oct 1973).

The reactions of niobium(V) with catechol and several substituted derivatives were studied. Optimal conditions for color development in the niobium(V)–catechol system are: pH 6.7 to 8.0, and heating at 85° for at least 6 min; the wavelength of maximal absorption is 365 nm, and the molar absorptivity is $1.02 \times 10^4$. Catechol derivatives require lower temperatures and develop colors with niobium(V) in neutral or slightly acidic solutions. The best of the derivatives studied were 3-methylcatechol and 4-chlorocatechol. Extraction of the ion-pairs formed between niobium(V)–catechol and different quaternary ammonium ions was studied with representative solvents. Similar studies were made on other refractory metal ions, i.e., Ti(IV), V(V), Mo(VI) and W(VI), under the optimal conditions for the reaction with niobium(V). Separations of binary (1:1) mixtures of niobium(V) with Ti(IV), V(V), Mo(VI) or W(VI) at the $5 \times 10^{-5}$ M level were found to be possible under the predicted conditions. (auth)

**108** PRECIPITATION OF THE ALKALI METALS WITH HEXAFLUOROPHOSPHATE AND HEXAFLUOROARSENATE. Nadjafi, A. (Univ. of Birmingham, Eng.). Mikrochim. Acta; No. 5, 689-696(1973).

The separation of the heavier alkali metals from the lighter ones by precipitation with hexafluorophosphate ($PF_6^-$) and hexafluoroarsenate ($AsF_6^-$) was attempted. It was not possible to obtain a satisfactory separation of potassium from the two heavier alkali metals. The alkali metal salts of hexafluorophosphoric acid were prepared and characterized, and their solubilities were determined under comparable conditions, by means of atomic absorption spectrophotometry. Although the values of these solubilities gave some hope for useful analytical purposes, it was not possible to obtain a satisfactory separation of potassium from rubidium and cesium because of solubility and coprecipitation effects. (auth)

**109** QUALITATIVE ANALYSIS SCHEME BASED ON THE PROPERTIES OF ION EXCHANGERS. Machiroux, R.; Merciny, E.; Schreiber, A. (Univ., Liege). Mikrochim. Acta; No. 5, 829-840(1973). (In French).

A systematic scheme of qualitative analysis of some cations is presented. For didactic purposes the properties of cationic and anionic ion exchangers were used. At the present time, this scheme is limited to 23 ions, including Sr. (auth)

**110** STUDIES ON THE LOW GAS FLOW RATE FOAM SEPARATION OF U(VI) FROM SULFATE MEDIA. Shakir, K. (Atomic Energy Establishment, Inshas, Egypt). Separ. Sci.; 8: No. 3, 345-362(1973).

The two low gas flow rate foam separation processes, "ion and precipitate flotation," were investigated for the separation of hexavalent uranium from dilute sulfate solutions at different conditions of pH, gas flow rate, and concentration of uranyl, collector, and sulfate ions using the anionic collector sodium lauryl sulfate and the two cationic collectors cetyltrimethylammonium bromide and laurylamine hydrochloride. No significant removal could be achieved with sodium lauryl sulfate, whereas cetyltrimethylammonium bromide and laurylamine hydrochloride gave high uranium recoveries. Precipitate flotation was generally less sensitive than ion flotation to all the factors tested, and both the rate and ultimate removal were much greater. Laurylamine hydrochloride causes a shift of the initial pH at which precipitate flotation begins to lower values, and the extent of shifting depends on the collector concentration. The reasons for this shift as well as the effects of the different factors on the flotation results are discussed. (auth)

**111** PURIFICATION OF BERYLLIUM BY SOLVENT EXTRACTION FROM CARBONATE SOLUTIONS WITH QUATERNARY ALKYLAMMONIUM CARBONATE. Seeley, F. G.; Crouse, D. J. (Oak Ridge National Lab., TN). Nucl. Technol.; 19: No. 3, 140-147(Sep 1973).

A process was developed for upgrading impure beryllium hydroxide to high-purity beryllium compounds. Crude beryllium hydroxide is dissolved in ammonium bicarbonate solution and extracted with a quaternary ammonium compound in a hydrocarbon diluent. Beryllium is recovered from the solvent extract with concentrated ammonium bicarbonate solution and precipitated as pure $Be(OH)_2$ by heating the solution to volatilize ammonia and carbon dioxide, which are recovered for recycle. Small concentrations of ethylenediaminetetraacetic acid are added to the process solutions to increase separations from contaminants. In a small-scale demonstration of the process starting with a beryllium sulfate solution containing 20 metal contaminants, including Th, U, Zr, Eu, and Mo, (total of $1.3 \times 10^5$-ppM parts of BeO) the BeO product had no detectable metal impurities but metalloid impurities (silicon and boron) of 60-ppM parts of BeO. Later tests showed that the boron content of the product can be reduced by adding a small amount of a boron complexing agent to the process solution. (auth)

**112** RELATIVE RETENTIONS OF SOME ALKYL ASTATIDES, IODIDES, AND BROMIDES ON DINONYL PHTHALATE. Kolachkovski, A.; Norseyev, Yu. V. (Joint Inst. for Nuclear Research, Dubna). J. Chromatogr.; 84: No. 1, 175-180(12 Sep 1973).

The relative retention values of the alkyl astatides ($C_1$ to $C_5$) and of the corresponding compounds of iodine and bromine on dinonyl phthalate columns were determined at various temperatures. It is concluded that the relative retentions of the organic astatine, iodine, and bromine compounds can be used for analytical purposes as well as for the determination of some physical and chemical parameters of these compounds. (JGB)

**113** INFLUENCE OF COMPLEX FORMATION ON THE CHROMATOGRAPHIC BEHAVIOR OF INORGANIC IONS ON SODIUM CARBOXYMETHYLCELLULOSE AND DOWEX 50-X4($Na^+$) THIN LAYERS. Lepri, L.; Desideri, P. G. (Univ., Florence). J. Chromatogr.; 84: No. 1, 155-164(12 Sep 1973).

The chromatographic behavior of 16 metal ions, including Sr, on thin layers of sodium carboxymethylcellulose and Dowex 50-X4($Na^+$) was investigated. The eluents used were acetate, gluconate, lactate, and oxalate buffer solutions at constant ionic strength. The influence on the $R_F$ values of some parameters (the affinity of the ions for the exchanger, the concentration and the type of buffer solution) was determined. Criteria are proposed for the analytical use of these parameters. The stability constants of the complexes with the above ligands and the selectivity coefficients of the ions for the two exchangers were calculated. Finally, the validity of the method for the determination of the stability constants for mono- and bidentate ligands is discussed. (auth)

**114** TEMPERATURE EFFECTS IN EXTRACTION OF SEXIVALENT MOLYBDENUM INTO DI(2-ETHYLHEXYL)PHOSPHORIC ACID FROM ACID SOLUTIONS. Palant, A. A.; Reznichenko, V. A. J. Appl. Chem. USSR (Engl. Transl.); 46: No. 5, 1124-1127(May 1973).

Translated from Zh. Prikl. Khim.; 46: No. 5, 1062-1065(May 1973).

Results of a study on the effects of temperature on the extraction of $Mo^{6+}$ into D2EHPA from sulfuric, hydrochloric, and nitric acid solutions are reported. Experimental data indicate that in most cases an increase in temperature leads to decreased extraction of molybdenum. (JGB)

**115** REVERSED-PHASE EXTRACTION CHROMATOGRAPHY USING A TETRA-SUBSTITUTED PYRAZOLE AS STATIONARY PHASE. Brinkman, U. A. Th.; Taphoorn, J. H.; De Vries, G. (Free Reformed Univ., Amsterdam). J. Chromatogr.; 84: No. 2, 407-411(26 Sep 1973).

The use of two extractants, 1-methyl-3,5-dipentyl-4-butylpyrazole and 1-phenyl-3,5-dipentyl-4-butylpyrazole was studied in the separation by reversed-phase extraction chromatography of metal ions on silica gel. Both pyrazoles gave excellent results in most cases. Included in the metals for which results are given are: Mo, Sc, Y, rare earths, Th, Zr, and U. (JGB)

**116** ANTAGONISTIC EFFECTS IN REVERSE PHASE PARTITION AND SOLVENT EXTRACTION OF Ru(III) FROM HCl SOLUTIONS. Saraiya, V. N.; Venkateswarlu, K. S.; Shankar, J. (Bhabha Atomic Research Centre, Trombay, India). Indian J. Chem.; 11: No. 5, 490-493(May 1973).

The antagonistic effects of n-octanol, cyclohexanol, and chloroform on the reverse phase partition and extraction of Ru(III) by tri-n-octylphosphine (TOP), tri-n-octylphosphine oxide (TOPO), tri-n-butylphosphine oxide (TBPO), tri-n-hexylamine (THA), and tricaprylmethylammonium chloride (Aliquat-336) were studied. It is found that the decrease in partition of Ru(III) in the presence of n-octanol and cyclohexanol is due to the adduct formation of these antagonistic with TOP, TOPO, TBPO, THA, and Aliquat-336, thereby reducing the free [extractant]. Similar behavior was noticed during liquid–liquid extraction also. (auth)

**117** EFFECT OF HYDRATION ON AMINE EXTRACTION. Frolov, Yu. G.; Sergievskii, V. V.; Zuev, A. P. At. Energ. (USSR); 35: No. 2, 109-116(Aug 1973). (In Russian).

A method is described for determining extractant activity $\alpha_2^*$ for ternary homogeneous solutions: Solvent (1)–extractant (2)–water (3), in accordance with the equation $\ln \alpha_2^* = \ln \alpha_2 - (m_1/m_2) \ln (\alpha_1^*/\alpha_1) - (1/m_2) \int_0^{m_3} (m_3/\alpha_3) (da_3/dm_3)\, dm_3$ (m is the component molality and $\alpha$ is its activity in binary solutions) from data of cryoscopic and isopiestic measurement. The use of experimental activity coefficients of amine salts results in satisfactorily stable coefficients of extraction of sulfuric and nitric acids by benzene solutions of ternary aliphatic amines. A disagreement noted by some authors between the degrees of association of amine salts determined from extraction data and independent physico-chemical measurements is explained by the effect of water on salt activity. Water has been established to have a determining effect on the extraction of metal salts by substituted ammonium bases of sulfuric solutions. The contrasting effect of water on the extraction of acids and metal salts is shown. It has been established that for $m_2 \to 0$ the decrease in the activity of an extractant subjected to hydration is determined quantitatively by its degree of hydration h ($\ln \alpha_2/\alpha_2^* = h$). This conclusion is confirmed experimentally in the case of benzene solutions of various amine salts, tri-n-butyl phosphate, and di-2-ethylhexylphosphoric acid. The effect of hydration in the organic phase on extraction equilibrium is considerable when the distribution does not follow Henry's law. (auth)

**118** CONTINUOUS ELECTROPHORETIC SEPARATION OF $^{106}Ru$ SPECIES IN SEA WATER AND UPTAKE OF THE SEPARATED FRACTIONS BY SEA ALGAE. Ishikawa, M.; Pucar, Z. (Rudjer Boskovic Inst., Zagreb). J. Radioanal. Chem.; 14: No. 1, 53-61(Mar 1973).

Ruthenium-106 chloro and nitrosyl-nitrato complexes in sea water were separated into several species by continuous electrophoresis on a filter paper curtain. Biological uptake experiments were carried out on sea algae Fucus virsoides with fractionated $^{106}Ru$ chloro and nitrosyl-nitrato complex species in sea water. The biological uptake of $^{106}Ru$ chloro complex species was about 8 times higher than the uptake of $^{106}Ru$ nitrosyl-nitrato species. Electrophoretically most mobile electrically positively charged cationic species in both systems also showed about 8 times higher biological uptake than the most mobile negatively charged anionic species. A close relation of the biological uptake to the sign of the electrical charge and the electrophoretic mobility of the species is demonstrated. The results are discussed with respect to possible danger to the biological environment as a consequence of the aging of ruthenium species in sea water resulting from $^{106}$Ru waste disposal to the sea from a nuclear reprocessing plant. (auth)

**119** ADSORPTION BEHAVIOR OF $^{99}$Mo AND URANIUM ON ALUMINA IN NITRIC ACID. El Bayoumi, S.; Hladik, O.; Muenze, R. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.). Isotopenpraxis; 9: No. 4, 131-132(Apr 1973).

In an attempt to establish optimum conditions for the adsorption of $^{99}$Mo on alumina from $HNO_3$ solutions containing large amounts of uranium, the behavior of the system U(VI)$-HNO_3-$Mo was studied. Distribution coefficients were determined in equilibrium experiments for solutions with varying $HNO_3$ content (0.04 to 12N) and for uranium contents of 2.5 to 600 mg U/ml. For $^{99}$Mo, $K_d$ values achieve a maximum in the proximity of 0.1N $HNO_3$, followed by a continuous decrease with further increasing acid content. The distribution coefficients of $^{99}$Mo decrease with increasing U concentration. (JGB)

## Inorganic, Organic, and Physical Chemistry

*Refer also to abstracts 2, 14, 220, 843, and 990–992.*

### Chemical and Physicochemical Properties

*Refer also to abstracts 201, 942, 1027, 2352, 2364, 2371, 2380–2382, 2390, and 2402.*

**120** (CONF-730525-, pp 127-137) PREPARATION, ANALYSIS AND $^{15}$N$-$NMR OF $^{15}$N-LABELLED BIOLOGICAL MOLECULES. Lapidot, A.; Irving, C. S.; Malik, Z. (Weizmann Inst. of Science, Rehovot, Israel). 1973.

From 1st international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

The application of total capability isotope research facilities to the preparation, analysis, and physical studies of $^{15}$N-labelled biological molecules is discussed, taking the preparation of $^{15}$N-hemoglobin ($^{15}$N > 50%) as an example. Strategies for biosynthesis of highly isotopically enriched proteins and enzymes are presented, with particular attention being given to a comparison in terms of yield and economy between the use of whole animals, tissue cultures and cell-free systems, the use of algal amino acid mixture as the $^{15}$N source, and the application of glc-mass fragmentography for the determination of the isotope enrichment of various amino acid groups in a labeled macromolecule. The Fast Fourier Transform $^{15}$N$-$NMR spectra of several biologically interesting molecules is presented to demonstrate the potential of $^{15}$N$-$NMR. These include (a) an algal amino acid mixture, which demonstrates the resolving power of $^{15}$N$-$NMR, (b) pigment mixture, the first $^{15}$N$-$NMR of chlorophylls, (c) glycine and glycyglycine, which demonstrates the ability of $^{15}$N$-$NMR to determine subtle changes in the distribution of electron density in amino and peptide functional groups as function of pH, and (d) $^{15}$N-labelled macromolecules. (auth)

**121** (CONF-730525-, pp 436-441) SURVEY OF PRODUCTION AND STUDIES OF CARBON-13. Eck, C. F. (Mound Lab., Miamisburg, OH). 1973.

From 1st international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

An overall survey of the present status of carbon-13 was made. Current production is briefly reviewed and a summary of available labeled compounds from commercial sources is presented. Reported work on carbon-13 over recent years was surveyed. This showed that much of the work was on NMR studies. Considerable nuclear energy level and reaction studies were also made. (auth)

### Isotope Effects

*Refer also to abstracts 36, 209, 791, 798, 841, and 842.*

**122** (CONF-730525-) PROCEEDINGS OF THE FIRST INTERNATIONAL CONFERENCE ON STABLE ISOTOPES IN CHEMISTRY, BIOLOGY, AND MEDICINE, MAY 9–11, 1973, ARGONNE, ILLINOIS. Klein, P. D.; Peterson, S. V. (eds.). (Argonne National Lab., Ill.). 1973. 477p. Dep. NTIS $10.60.

Separate abstracts were prepared for 21 of the 57 papers appearing in these proceedings. The other 36 papers are presented under the following general headings: synthesis with stable isotopes; NMR spectroscopy; ESR and ENDOR spectroscopy; biological isotope effects; instrumentation for stable isotopes; drug quantitation by mass fragmentography; and clinical applications of stable isotopes. (ERB)

*For abstracts of individual papers see: 36–38, 120, 121, 123–125, 143–145, 790, 791, 798, and 841–847.*

**123** (CONF-730525-, pp 187-195) DEUTERIUM ISOTOPE EFFECTS IN LIVING ORGANISMS. Finkel, A. J. (Division of Scientific Activities, Chicago). 1973.

From 1st international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

Deuterium isotope effects on biological systems have been studied since the separation of this isotope in 1932 and have been examined more intensively during the past 15 years. Despite the many detailed investigations of the biophysics, biochemistry, physiology, and pathology of deuterium isotope effects, there is not a full understanding as to why higher organisms fail to cope with more than 30 to 35% substitution of $D_2O$ for $H_2O$ in body fluids. Neither is there a preliminary comprehension of how deuterated compounds may affect the sequence of normal and of pathological events in the body. Deuterium studies on mice, rats, and dogs are reviewed. Speculation is made on the extension of these findings to man and especially to human clinical situations. (JGB)

**124** (CONF-730525-, pp 235-238) NITROGEN ISOTOPE EFFECTS ON PAPAIN CATALYZED AMIDE HYDROLYSIS. O'Leary, M. H.; Urberg, M. (Univ. of Wisconsin, Madison). 1973.

From 1st international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

The effects of $^{15}$N on the hydrolysis of N-acetyl-L tryptophanamide catalyzed by bovine $\alpha$-chymotrypsin and on the papain-catalyzed hydrolysis of N-benzoyl-L-argininamide were determined. An appreciable nitrogen isotope effect was observed in the chymotrypsin-catalyzed hydrolysis and the isotope effect in the case of the papain-catalyzed hydrolysis was twice as large. The isotope effects indicate that the carbon-nitrogen bond breaking step is at least partially rate determining in the case of the former hydrolysis and is even more significant in the latter. (ERB)

**125** (CONF-730525-, pp 442-447) ELECTRON PARAMAGNETIC RESONANCE ABSORPTION STUDY OF A GASEOUS MIXTURE OF $N^{16}O$, $N^{17}O$ AND $N^{18}O$. Jarke, F. H.; Solomon, I. J.; Ashford, N. A. (IIT Research Inst., Chicago). 1973.

From 1st international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

The X-band electron paramagnetic resonance absorption of a gaseous mixture of $^{14}N^{16}O$, $^{14}N^{17}O$ and $^{14}N^{18}O$ was investigated. Data demonstrating the effect that the various oxygen isotopes have on the EPR spectra of this linear diatomic molecule were obtained. The $^{17}$O hyperfine interaction was found to be ≈57.4 gauss and a large $^{17}$O quadrupole interaction is indicated. The s character of the 2p$\pi$ electron on oxygen in nitric oxide is estimated to be 2.0%, which is in good agreement with that estimated for the isoelectronic molecule $^{17}O_2^-$. It is concluded that the data obtained, coupled with data previously published in the literature on $^{14}N^{16}O$ and $^{15}N^{16}O$, plus data to be obtained in the future on $^{15}N^{17}O$ and $^{15}N^{18}O$, will ultimately lead to a unified theory of isotopic effects in nitric oxide. (auth)

**126** (COO-2192-2) DEUTERIUM ISOTOPE EFFECTS IN ELECTRONIC RELAXATION OF LARGE POLYATOMIC MOLECULES. Progress Report, October 1, 1972–September 30, 1973. Lim, E. C. (Wayne State Univ., Detroit, Mich. (USA)). 1973. Contract AT(11-1)-2192. 7p. Dep. NTIS $3.00.

Experimental and theoretical studies of radiationless transitions in "isolated" naphthalene were carried out. The results indicate that the internal conversion to the ground state dominates over intersystem crossing at high excess energies, and that rapid vibrational energy redistribution does not take place after excitation. A study of isotope effect on intersystem crossing in condensed phase suggests that the deuteration enhancement of intersystem crossing may indeed be related to the presence of a higher triplet state which is nearly degenerate to the lowest excited singlet state. Evidence is obtained indicating that the radiative lifetime of the lowest triplet state is considerably longer for predeuterated aromatic hydrocarbons than for the corresponding preprotonated compounds. (auth)

**127** CARBON-13 NUCLEAR MAGNETIC RESONANCE SPECTRA OF KETO STEROIDS. Eggert, H.; Djerassi, C. (Stanford Univ., CA). J. Org. Chem.; 38: No. 21, 3788-3792(19 Oct 1973).

Fourier transform C-13 nuclear magnetic resonance spectra were obtained and assigned for a complete series of keto steroids—the steroid skeletons being those of androstane and cholestane. The assignments were performed by comparing the spectra of these closely related compounds and correlating the shifts due to differences in structure, and by use of off-resonance decoupled spectra. Furthermore, the spectra of a series of specific deuterium-labeled analogs were obtained for assignment purposes. The assignments show strong internal consistency. It is shown that previous assignments to C-12 and C-16 in these systems is erroneous. The effects of deuterium substitution in the steroid system are described, and the observed deuterium isotope shifts are presented. (auth)

**128** MECHANISM FOR LYSOZYME-CATALYZED HYDROLYSIS. Smith, L. E. H.; Mohr, L. H.; Raftery, M. A. (California Inst. of Tech., Pasadena). J. Amer. Chem. Soc.; 95: No. 22, 7497-7500(31 Oct 1973).

Secondary $\alpha$-tritium kinetic isotope effects were utilized to probe the nature of the transition state in the lysozyme-catalyzed hydrolysis of chitotriose. A general synthesis of specifically labeled chitin oligomers (in particular 1,1′,1″-[$^3$H]chitotriose, the substrate used in these studies) is described. Injection of Drosophila melanogaster larvae with labeled N-acetyl-D-glucosamine yields chitin, which can be hydrolyzed to give a range of chitin oligomers from chitobiose to chitoheptose. The value of $k_H/k_T$ obtained for the lysozyme-catalyzed hydrolysis of chiotriose was found to be 1.19. This result indicates very considerable carbonium ion character in the transition state, and thus the mechanistic alternatives for lysozyme hydrolysis become distinguishable. (auth)

**129** KINETIC ISOTOPE EFFECTS FOR REACTIONS OF METHYL FORMATE-METHOXYL-$^{18}$O. Sawyer, C. B.; Kirsch, J. F. (Univ. of California, Berkeley). J. Amer. Chem. Soc.; 95: No. 22, 7375-7381(31 Oct 1973).

Values of $k_{^{16}O}/k_{^{18}O}$ were measured for several reactions of methyl formate-methoxyl-$^{18}$O. The ratios for acid-catalyzed hydrolysis, alkaline hydrolysis, and general base catalyzed hydrolysis in succinate buffer are 1.0009 ± 0.0004, 1.0091 ± 0.0002, and 1.0115 ± 0.0002, respectively. The maximum expected effect, 1.052, for rate-determining scission of the acyl carbon-methoxyl oxygen bond was calculated from the observed difference in the stretching frequencies between $^{16}$O and $^{18}$O ester. The observed isotope effect for hydrazinolysis under conditions of rate-determining breakdown of the tetrahedral intermediate at low pH is 1.0621 ± 0.0008, while at high pH, where attack of hydrazine on the ester or a proton transport step is rate determining, it is only 1.0048 ± 0.0006. The values of the ratios of the rates of hydrolysis to carbonyl oxygen exchange for methyl formate are 11.4 ± 0.1 in acid and 18.3 ± 0.4 in alkaline solution. The extremely small kinetic isotope effect observed for acid-catalyzed hydrolysis suggests a mechanism in which equilibrium protonation of the ester is counterbalanced by the normal kinetic isotope effect for the attack of water on the oxocarbonium ion. The small but significant isotope effects observed for alkaline hydrolysis, general base catalyzed hydrolysis, and hydrazinolysis at high pH suggest a transition state in which the order of the acyl carbon-methoxyl oxygen bond of 1.15 in the ester is only slightly reduced in the transition state. (auth)

**130** SECONDARY DEUTERIUM ISOTOPE EFFECTS FOR ADDITION OF NITROGEN NUCLEOPHILES TO SUBSTITUTED BENZALDEHYDES. do Amaral, L.; Bastos, M. P.; Bull, H. G.; Cordes, E. H. (Univ., Sao Paulo, Brazil). J. Amer. Chem. Soc.; 95: No. 22, 7369-7374(31 Oct 1973).

Kinetic secondary deuterium isotope effects, $k_D/k_H$, for the water-catalyzed addition of semicarbazide to a series of substituted benzaldehydes are near 1.30 and are independent of the nature of the polar substituent; corresponding values for the same reaction catalyzed by the hydrated proton and other acids are near 1.21. Values of $k_D/k_H$ for the water-catalyzed addition of phenylhydrazine to substituted benzaldehydes decrease from 1.28 to 1.16 as the nature of the polar substituent is varied from p-methoxy to p-nitro. The corresponding values for the same reaction catalyzed by the hydrated proton decrease from 1.21 to 1.13 for the same substituents. These results indicate that the extent of carbon–nitrogen bond formation in the transition state for addition of nucleophiles to the carbonyl group is a function of the reactivity of substrate, nucleophilic reagent, and the strength of the catalyzing acid. The secondary deuterium isotope effect on the equilibrium constant for carbinolamine formation from benzaldehyde and hydroxylamine is near 1.36, larger than the largest of the kinetic effects observed. Under conditions in which carbinolamine dehydration is rate determining, values of $k_D/k_H$ for the overall rate of semicarbazone formation from benzaldehydes decrease from 1.31 to 1.20 as the nature of the polar substituent varies from hydrogen to p-nitro. This result demonstrates that the extent of carbon-oxygen bond cleavage in the transition state for carbinolamine dehydration is a function of the nature of the polar substituent of the substrate. Moreover, for those substituents which are not strongly electron withdrawing, the transition state closely resembles the carbinolamine itself. (auth)

**131** LACTONIZATION OF RING-SUBSTITUTED COUMARINIC ACIDS, STRUCTURAL EFFECTS ON THE PARTITIONING OF TETRAHEDRAL INTERMEDIATES IN ESTERIFICATION. Hershfield, R.; Schmir, G. L. (Yale Univ., New Haven). J. Amer. Chem. Soc.; 95: No. 22, 7359-7369(31 Oct 1973).

The kinetics and equilibria of the lactonization of 13 ring-substituted coumarinic acids were studied in aqueous solution at pH 0 to 6 and 30°. The pH-rate profiles were interpreted in terms of a mechanism including cationic and neutral tetrahedral addition intermediates in acid-base equilibrium. At low pH, the formation of the intermediates via acid-catalyzed and uncatalyzed pathways is rate determining. With 12 of the substrates,there occurs, at higher pH, a change in rate-determining step to breakdown of the intermediates via acid-water-, and base-catalyzed paths. The pH values at which the transition in rate-limiting step takes place, as well as the partitioning of the intermediates between reactant and products, are strongly influenced by substituents. Hammett correlations of these and other kinetic constants are discussed. Stabilization of an incipient oxocarbonium ion seems to be an important factor in determining the mode of breakdown of the cationic tetrahedral intermediate. Solvent deuterium isotope effect in the lactonization of coumarinic acid was determined at several acid concentrations. (auth)

**132** HETEROGENEOUS ISOTOPE EXCHANGE, CRYSTAL GROWTH, AND DISSOLUTION OF IONIC CRYSTALS. Lang, G. Darmstadt, Ger.; Technische Univ. (1971). 4p. (In German). Thesis.

An investigation was carried out on the kinetics of the reaction-determining steps in the isotope exchange of ion crystals and dissolved ions, as well as in the crystal growth from supersaturated solutions and of the dissolution of ion crystals in water occurring on the ion crystal/solution boundary surface or in the diffusion layer of the lead sulfate system. (GE)

**133** REACTION OF OXYGEN ATOMS, O($^3$P), WITH ETHYLENE IN LIQUID NITROGEN SOLUTION. Hirokami, S.; Cvetanovic, R. J. (National Research Council of Canada, Ottawa). Can. J. Chem.; 51: No. 3, 373-381(1 Feb 1973).

The reaction of ground-state oxygen atoms, O($^3$P), with ethylene and ethylene-$d_4$ in liquid nitrogen solution at 77°K was studied. The major and perhaps the exclusive products are ethylene oxide and acetaldehyde. The ratio of acetaldehyde to ethylene oxide is 1.2 ± 0.1 for ethylene and 0.91 ± 0.09 for ethylene-$d_4$. Much smaller amounts of formaldehyde and trace quantities of cyclopropane are also observed. The effect of the concentration of ethylene on the quantum yields of addition products was measured. A limiting quantum yield of oxygen atoms scavenged by ethylene to form the addition products was 0.12 ± 0.01. The low quantum yield suggests an appreciable cage recombination of the ground-state oxygen atoms with the trace amounts of molecular oxygen present. The effect of the concentration of added oxygen on the product yields and the relative rate constant for the addition of O($^3$P) to molecular oxygen and to ethylene were determined. The ratio $k(O+O_2)/k(O+C_2H_4)$ is 6.0 ± 1.0 and the relative rate constant for the addition of O($^3$P) to ethylene and to ethylene-$d_4$, $k(O+C_2D_4)/k(O+C_2H_4)$ is 2.0 ± 0.1. The type of products formed and the isotope effects observed are discussed in terms of the mechanism of addition of $O^3$(P) atoms to ethylene. (auth)

**134** ISOTOPE EFFECTS ON CHEMICAL EQUILIBRIA. Part 1. Some Secondary Isotope Effects of the Second Kind. Barnes, D. J.; Scott, J. M. W. (Memorial Univ. of Newfoundland, St. John's). Can. J. Chem.; 51: No. 3, 411-421(1 Feb 1973).

Secondary isotope effects $K_a(H)/K_a(D)$ for the isotopic acid pairs 4-X-$C_6H_4CH_2COOH$/4-X-$C_6H_4$-$CD_2COOH$(X = H, $NO_2$, OMe) were determined at T = 25°C by conductance measurements. This has involved the redetermination of the dissociation constants for the nondeuterated acids and in the case of X = $NO_2$, $OCH_3$, the new $K_a$ values are to be preferred. The $K_a$ of acetic acid was also redetermined as a check on the reliability of the new data. The three isotope effects are shown to be much smaller than might have been anticipated on the basis of the emf measurements on the pair $PHCH_2COOH/PhCD_2COOH$. (auth)

**135** TEMPERATURE DEPENDENCE OF ACTIVATION VOLUMES OF SOLVOLYSIS REACTIONS IN LIGHT AND HEAVY WATER. Davis, C. S.; Hyne, J. B. (Univ. of Calgary, Alberta). Can. J. Chem.; 51: No. 11, 1687-1692(1 Jun 1973).

The pressure dependence of the solvolysis rates for benzyl chloride, isopropyl bromide, and methanesulfonyl chloride in $H_2O$ and $D_2O$ were measured. The temperature dependence of the activation volumes appears to be indicative of the mechanism of solvolyses and the differences in the temperature dependence of the activation volumes for the two solvents are consistent with $D_2O$ being the more structured. The more extensive data in the case of methanesulfonyl chloride deuterolysis indicates extremum behavior in $\Delta V^*$ as a function of temperature in the 5-25°C range. (auth)

**136** RELATIVE NUCLEOPHILICITIES OF WATER AND HEAVY WATER. Pradhan, D. G. (Bhabha Atomic Research Centre, Trombay, India). Indian J. Chem.; 11: No. 4, 345-347 (Apr 1973).

An experiment is described to compare directly the nucleophilicities of water and heavy water. It is found that $H_2O$ is more nucleophilic than HDO which in turn is more nucleophilic than $D_2O$. The results are explained in terms of secondary isotope effect of steric origin resulting from zero-point stretching vibrations of O-H and O-D bonds. This observation is shown to be promising for developing a simple and economic method for the large-scale production and enrichment of heavy water. The novelty of the technique is the preferential removal of heavy water in the initial stages and the determination of the nature and magnitude of structure-making and structure-breaking effects of salts and nonelectrolytes in water. (auth)

**137** FAR-INFRARED SPECTRA OF t-BUTYL BROMIDE-$h_9$ AND -$d_9$ IN THE LIQUID AND THREE SOLID PHASES. Bertie, J. E.; Sunder, S. (Univ. of Alberta, Edmonton). J. Chem. Phys.; 59: No. 1, 498-501(1 Jul 1973).

The far-infrared spectra of the liquid and three solid phases of t-butyl bromide-$h_9$ and -$d_9$ were recorded between 200 and 10 $cm^{-1}$. Strong absorption only occurs below 100 $cm^{-1}$, where the liquid and the two plastic crystal phases, I and II, show a broad featureless band, whose frequency of maximum absorption increases with decreasing temperature. Relaxation processes and mixed translational-rotational vibrations contribute to the band, but the vibrations determine the frequency of maximum absorption. The spectra of solid phase III at 90°K show eight features that are assigned to lattice modes and indicate that the solid is ordered with at least two molecules per primitive unit cell. At 195°K phase III is orientationally disordered. (auth)

**138** MICROWAVE SPECTRUM, BARRIER TO INTERNAL ROTATION, STRUCTURE, AND DIPOLE MOMENT OF METHANE SELENOL. Thomas, C. H. (Univ. of Cincinnati). J. Chem. Phys.; 59: No. 1, 70-76(1 Jul 1973).

The microwave spectra of the ground state and excited torsional states of several isotopic species of methane selenol were observed. The barrier hindering internal torsion was determined to be 1001 ± 50 cal/mole. The structural parameters are $C-Se = 1.959$ Å, $Se-H = 1.473$ Å, $C-H = 1.088$ Å, $\angle C-Se-H = 95.45°$, $\angle H-C-H = 110.00°$, with the symmetry axis of the methyl group tilted 1.5° away from the C−Se internuclear line. The dipole moment components are $\mu_A = 1.253$ D, $\mu_B = 0.314$ D, $\mu_{total} = 1.291$ D. The implications of this barrier height determination for theories on the orgin of the barrier are discussed. (auth)

**139** MONTE CARLO CALCULATIONS OF REACTION RATES AND ENERGY DISTRIBUTIONS AMONG REACTION PRODUCTS. IV. $F + HF(\nu) \rightarrow HF(\nu') + F$ and $F + DF(\nu) \rightarrow DF(\nu') + F$. Wilkins, R. L. (Aerospace Corp., El Segundo, CA). J. Chem. Phys.; 59: No. 2, 698-704(15 Jul 1973).

Rate constants are calculated for the vibrational relaxation $HF(\nu)$ and $DF(\nu)$ molecules by F atoms with $\nu = 1, 2, 3$, and 6. Three-dimensional classical trajectories of the collision dynamics of these reactions were calculated by means of a modified London-Eyring-Polanyi-Sata (LEPS) potential energy surface used to calculate rate constants for the reactions between H atoms and $F_2$ molecules, and D atoms and $F_2$ molecules. The Monte Carlo procedure is used to start each collision trajectory. By means of this calculation, it is predicted for the reactant HF molecule in the $\nu = 2$, $J = 8$ state that 13.3% of the mean fraction of available energy will become rotation in the product HF, 80.7% will become vibrational energy in the product HF, and 6% will become relative translational energy of the products. As the vibrational energy of the reactant HF molecule increases, the mean fraction of available energy that becomes rotational energy increases slightly. For example, if the reactant molecule HF is in the $\nu = 6$, $J = 8$ state, it is found that the mean fraction of available energy that will become rotational energy in HF is 15.8%, 75.3% will become vibrational energy in HF, and 8.9% will become translational energy in the product. Two different methods are used to calculate the rate constants $k_{\nu\rightarrow\nu-1}$ for the de-excitation of vibrationally excited HF molecules by F atoms. The main mechanism for the de-excitation of vibrationally excited HF or DF molecules by F atoms is vibration-rotation energy transfer. Multiple quantum transitions occur in the de-excitation of higher ($\nu \geq 3$) vibrationally excited states of HF molecules by F atoms. Chemical effects provide an important mechanism for the efficient vibrational relaxation of HF and DF molecules by F atoms. Rate constants are provided for many reactions that have not been measured experimentally. (auth)

**140** MOLECULAR REORIENTATIONAL MOTION IN LIQUID ACETONITRILE: RAMAN BAND SHAPES, DIFFUSION CONSTANTS, AND ACTIVATION ENERGY OF REORIENTATION. Griffiths, J. E. (Bell Telephone Labs., Murray Hill, NJ). J. Chem. Phys.; 59: No. 2, 751-758(15 Jul 1973).

Isotropic $I_\alpha(\omega)$ and anisotropic $I_\beta(\omega)$ Raman band shape analyses of the $\nu_1(\alpha_1)$ fundamentals in liquid $CH_3CN$ and $CD_3CN$ are reported. The $\nu_2$ and $\nu_4$ fundamentals are complicated by secondary structure and therefore were not studied in detail. Values of the perpendicular rotational diffusion constants $D_\perp$, derived from the $\nu_1(\alpha_1)$ fundamentals of both isotopic species are in good agreement with those obtained using NMR relaxation and dielectric methods and in addition agree closely with values calculated from microviscosity theory. The latter is based upon a model which involves a connection between the rotational and translational motions in liquids. In this model, reorientations perpendicular to the $C_3$ axis proceed by small step Brownian diffusion and $D_\perp$ (Raman) for $CD_3CN$ yields an activation energy for liquid state molecular reorientations perpendicular to the $C_3$ symmetry axis of 2.0 ± 0.3 kcal/mole, in good agreement with existing NMR and microviscosity values. Comparison of Raman data and results reported here with available infrared results reveals that the $D_\perp$(ir) values are too high by a factor of 2. The source of the infrared errors is discussed. (auth)

**141** MASTER EQUATION FOR THE DISSOCIATION OF A DILUTE DIATOMIC GAS. 8. The Rotational Contribution to Dissociation and Recombination. Ashton, T.; McElwain, D. L. S.; Pritchard, H. O. (York Univ., Toronto). Can. J. Chem.; 51: No. 2, 237-259(15 Jan 1973).

The dissociation of the $J = 21$ state of $H_2$ and the recombination of atoms into that state were examined in detail. It is shown that if full rotational equilibration is assumed, the sum, weighted over all J, of the individual dissociation rate constants leads to an overall dissociation rate constant which is much too high, suggesting strongly that rotational equilibration cannot occur among the very high J states. A factored form of the master equation is then examined in which either only T-V or only T-R processes takes place, over the temperature range 1500 to 5000°K. It is found that in this approximation the upper rotational states are very strongly depleted, and that the Arrhenius temperature coefficients of the dissociation rate constants are between 92 and 94 kcal $mol^{-1}$, depending upon the choice of rotational transition probabilities. The calculation suggests that one contributory cause of "low activation energies" in dissociation reactions is strong rotational depopulation of the very high rotational states, and its importance in relation to other possible causes is discussed. An exploratory series of calculations for deuterium was carried out for the range of temperatures 700 to 5000°K, using the latter model which includes full coupling between rotation, vibration and dissociation. These calculations predict that there should be a reversal in the isotope effect for both dissociation and recombination of hydrogen and deuterium. (auth)

**142** ISOTOPE EFFECT OF ION MOBILITY IN MOLTEN SALTS. Lyubimov, V. N. (Inst. of Organic Chemistry, Novosibirsk, USSR). Isotopenpraxis; 9: No. 4, 123-126(Apr 1973). (In Russian).

When considering the isotope effects of the electrotransport properties of molten salts, it is possible to use as the frame of reference the chemical element as a whole, the behavior of which is statistically composed by the behavior of the isotopes which form it. Such a frame of reference is especially convenient in case of multicomponent isotope mixtures. With the use of data on equivalent conductivity of molten salts, the absolute differences of the mobilities of the isotopic ions of those elements were calculated and the relative differences of the ion mobilities were measured. The isotope mobility increment is found to be of the order of magnitude $10^{-7}$ to $10^{-6}$ $cm^2\ V^{-1}\ s^{-1}$ for light elements like magnesium, potassium, and calcium and $10^{-8}$ $cm^2$ $V^{-1}$ $s^{-1}$ for heavy ones like lead. (auth)

### *Isotope Exchange and Isotope Separation*

*Refer also to abstract 847.*

**143** (CONF-730525-, pp 13-19) ACID-CATALYZED DEUTERIUM EXCHANGE. Werstiuk, N. H.; Kadai, T. (McMaster Univ., Hamilton, Ont.). 1973.

From 1st international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

It is demonstrated that the high temperature (>200°C)-dilute acid exchange method presents substantial advantages over other perdeuteration methods (e.g., base-catalysis, metal-catalysis, concentrated acid-catalysis) because of cost, simplicity of procedure, selectivity, freedom from steric effects and side reactions, high degree of isotope incorporation, essentially quantitative yields and most importantly, adaptability to large-scale preparations. Among the examples given are the hydration of norbornene, deuterium exchange between aniline hydrochloride and $D_2O$, and exchange in benzene and its derivatives as well as in benzoic acid. (JGB)

**144** (CONF-730525-, pp 103-118) DIFFERENTIAL EXCHANGE OF THE C2 HYDROGENS OF HISTIDINE SIDE CHAINS IN NATIVE PROTEINS: PROPOSED GENERAL TECHNIQUE FOR THE ASSIGNMENT OF HISTIDINE NMR PEAKS IN PROTEINS. Markley, J. L.; Cheung, S. M. (Purdue Univ., West Lafayette, IN). 1973.

From 1st international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

The rates of deuterium exchange at the C2-H position of individual histidine residues in native proteins were followed by means of $^1H$-NMR spectroscopy. Conditions were found for the differential exchange of the histidine residues of bovine ribonuclease A [4 histidines], soybean trypsin inhibitor (Kunitz) [2 histidines], chicken ovomucoid [4 histidines], and staphylococcal nuclease [3 histidines]. The factors influencing histidine C2-H exchange rates in proteins as well as uses of the differential exchange reaction for studies of protein structure are discussed. A general technique based on differential hydrogen exchange is proposed for assigning histidine NMR peaks of proteins to specific residues in the amino acid sequence. The procedure consists of correlating the rates of deuterium exchange of the histidine NMR peaks with the rates of tritium exchange into individual histidines. Model studies were carried out with the tripeptide glycl-histidylglycine. Tritium exchange into the tripeptide showed a normal primary deuterium isotope effect ($k_H/k_D = 7.5$) suggesting that the rate limiting step of the exchange reaction is the breakage of the carbon-hydrogen bond. (57 references.) (auth)

**145** (CONF-730525-, pp 255-260) STABLE ISOTOPE DISTRIBUTIONS BY NMR ZEUGMATOGRAPHY. Lauterbur, P. C. (Univ. of New York, Stony Brook). 1973.

From 1st international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

Examples of the use of NMR zeugmatographic techniques to detect isotopic hydrogen exchange processes in complex systems have been given. Applications to the study of hydrogen–deuterium exchange processes and isotopic distributions in biological objects seem possible, and other isotopes may also be used in the same way. Microscopic and macroscopic objects may be investigated, and one-, two-, and three-dimensional images may be generated. Although experimental details will differ, similar experiments may be done with solids. (auth)

**146** (JUL–949-PC) ACCLIMATIZED WIND TRACK FOR MEASUREMENT OF OXYGEN ISOTOPE FRACTIONATION IN ISOLATED LEAVES AND IN LEAF MODELS. Hotopp, W.; Foerstel, H. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Physikalische Chemie). May 1973. 45p. (In German). Dep. NTIS (U. S. Sales Only) $4.25.

The planning and layout of a small wind track in which fixed climatic conditions can be adjusted are presented. The facility was designed for model investigations concerning the oxygen isotope fractionation of fluid water exchanging with the water vapor of streaming air. Further measurements are planned to investigate the $^{18}O$ isotope enrichment within the leaf water of land plants. The wind track was built as a closed system. Wind velocities can be controlled between 0.5 and 3.5 m/sec within a temperature range of 5 to 35°C and the humidity can be controlled between 20 and 90%. With these data it is possible to simulate normal environmental conditions for land plants. (auth)

**147** (MLM–2068) MOUND LABORATORY ACTIVITIES FOR THE DIVISION OF PHYSICAL RESEARCH: JANUARY–JUNE 1973. Cave, W. T.; Vallee, R. E. (Mound Lab., Miamisburg, Ohio). 22 Aug 1973. Contract AT(33-1)-Gen-53. 58p. Dep. NTIS $5.45.

Separate abstracts were prepared for the six sections of the report. (DHM)

*For abstracts of individual sections see: 148, 149, 227, 501, 502, and 965.*

**148** (MLM-2068, pp 12-31) SEPARATION RESEARCH. (Mound Lab., Miamisburg, Ohio (USA)). 22 Aug 1973.

In Mound Laboratory activities for the Division of Physical Research: January–June 1973.

**149** (MLM-2068, pp 32–47) LOW TEMPERATURE RESEARCH. (Mound Lab., Miamisburg, Ohio (USA)). 22 Aug 1973.

In Mound Laboratory activities for the Division of Physical Research: January–June 1973.

**150** BASE-CATALYZED ISOTOPIC EXCHANGE OF MOLECULAR HYDROGEN. 2. Rate Dependence on Basicity in the Dimethyl Sulfoxide–Water System. Symons, E. A.; Buncell, E. (Queen's Univ., Kingston, Ont.). Can. J. Chem.; 51: No. 11, 1673-1681(1 Jun 1973).

Isotopic exchange of $D_2$ was determined in mixtures of dimethyl sulfoxide and water under catalysis by hydroxide ion. The rate of exchange increases by ca. $10^4$ as the medium composition is changed from 0%DMSO to 99.6%DMSO at 65°C. The unusually low sensitivity to medium basicity is reflected in abnormally low slope values for the plots of log k vs. H- or J-. When [$Me_4NOH$] is varied at a given medium composition, the apparent order with respect to [$Me_4NOH$] is greater than unity. These results are discussed in terms of (1) rate determining proton transfer from $D_2$ to $OH^-$ with formation of hydride ion; (2) a concerted reaction of $OH^-$, $D_2$, and $H_2O$; (3) addition of $OH^-$ to $D_2$ to yield an intermediate adduct, $[HODD]^-$; (4) a 6-centered process involving cation participation and electrophilic assistance by $H_2O$ in the reaction of $OH^-$ with $D_2$. (auth)

**151** ACID AND BASE CATALYSIS OF OXYGEN EXCHANGE REACTIONS BETWEEN OXYANIONS AND WATER. Gamsjaeger, H. (Univ., Bern). Chimia (Aarau); 27: No. 9, 484–485(15 Sept 1973).

The qualitative kinetic features of oxygen exchange reactions between oxyanions and solvent water are summarized. A systematic tracer study of $^{18}O$ exchange reactions involving the system $BrO_3-H_2O(D_2O)$ was initiated. A kinetic analysis based on mass spectrometric measurements of $^{18}O$ abundances indicates that various mechanisms are effective in the $BrO_3^- - H_2O$ exchange reaction. Preliminary experiments were carried out on the systems, $ClO_3^- - H_2O$ and $IO_3^- - H_2O$. (JGB)

## Radiation Chemistry

*Refer also to abstracts 513, 528, 1029, 1031, 1032, and 1046.*

**152** (NBL-267, pp 105-106) CALCULATION OF HYDROGEN GENERATION FROM PLUTONIUM-INDUCED RADIOLYSIS OF NITRIC, SULFURIC, AND PERCHLORIC ACIDS. Weiss, J. R.; Pietri, C. E. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

Modifications were made to an existing equation so that the hydrogen produced by radiolysis in aqueous acidic solutions of plutonium can be calculated. The calculations show that storage of plutonium in high concentrations of $HNO_3$ produces a smaller quantity of hydrogen than storage in $H_2SO_4$ or $HClO_4$ solution. The explosion hazard thus is minimized in $HNO_3$ solution. (auth)

**153** (UCRL-51422, pp 5-7) THERMOLUMINESCENCE OF ASBESTOS. Distler, T. M.; Barry, P. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Jul 1973.

In fiscal year 1973 summary report for the USAEC Division of Applied Technology: environmental analysis.

Radioinduced thermoluminescence of asbestos was studied in an effort to develop a method for determining asbestos concentration in air. Results show that it is possible to distinguish between fibrous serpentine, which presents a health hazard, and the innocuous massive serpentine. However, other data indicate that quartz, an ubiquitous mineral, does have a relatively intense, radioinduced glow peak in the 250 to 300°C region. (DHM)

**154** (UCRL-51422, pp 10-16) USING THE THERMOLUMINESCENCE OF BEACH SAND AS A TRACER. Toy, A. J.; Sundbeck, C. W.; Barry, P. E. 5 Jul 1973.

In fiscal year 1973 summary report for the USAEC Division of Applied Technology: environmental analysis.

Feasibility and parameterization experiments were performed to determine if the thermoluminescence of sand would permit its use as a tracer to study the bottom movement in harbors and beaches. Samples exposed to $6 \times 10^5$ R of $^{60}$Co γ rays typically caused the samples to have integrated TL outputs (to 260°C) of several million counts. Unirradiated samples have essentially no signal in the 0° to 260°C region. This suggests that it should be possible to approach dilution factors of $10^6 : 1$ in optimum samples read with optimal readers. Therefore, the TL of sand could be used in experiments to trace the movement of beach and harbor bottoms if the experiment can be done with dilution factors of less than $10^6 : 1$. (DHM)

**155** MEASUREMENT OF THE DECOMPOSITION OF SILVER AZIDE DURING RADIOLYSIS BY A GAS EVOLUTION METHOD. Ryabykh, S. M.; Meshkov, V. A. (Tomsk Polytechnic Inst., USSR). Russ. J. Phys. Chem. (Engl. Transl.); 47: No. 3, 420-421(Mar 1973).

Translated from Zh. Fiz. Khim.; 47: No. 3, 740(Mar 1973).

The proposed experimental method of measuring the true extent of decomposition of solids during radiolysis is based on measurements of the rate of gas evolution as a function of the particle size of the sample. When the diameter of individual granules becomes equal to the thickness of the surface layer from which gas is evolved, the rate of gas evolution should not increase with further comminution since almost the whole of the radiolytic gas is evolved to the surroundings. This model was tested by studying the radiolysis of silver azide. The critical particle size and the radiation-chemical yield for this compound were determined. (auth)

**156** ELECTRON–NUCLEAR DOUBLE RESONANCE OF THE PROTONS OF THE STABLE RADICALS IN γ-IRRADIATED SINGLE CRYSTALS OF GLYCINE. Teslenko, V. V.; Krivenko, V. G. (Inst. of Semiconductors, Kiev). Stud. Biophys.; 38: No. 1, 25-40(1973). (In Russian).

The method of electron-nuclear double resonance (ENDOR) was used in investigation of hyperfine interactions of protons in irradiated glycine. Some of the ENDOR lines were described by the hyperfine constants of the protons of the $^+NH_3-\dot{C}H-COO^-$ radical. Angular dependence of the ENDOR frequency of the other protons was investigated. The hyperfine constants of three protons ($H_4$, $H_5$, $H_6$) were determined. The ENDOR spectra of the single crystal irradiated at 77°K and subsequently warmed to room temperature and the ENDOR spectra of the single crystal irradiated at room temperature were the same. Three protons ($H_4$, $H_5$, $H_6$) belong to the stable radical appearing by the decay $CH_2COO(H)$ radical. The observed triplet structure of ENDOR line seems to be due to magnetic dipole–dipole interactions of nuclei and the second-order effects of the hyperfine interactions of these three protons. The observed dependence of ENDOR-line intensities on the directions of the radiofrequency field about the crystal axis was accounted for by a change of nucleus transition probability magnitudes. (auth)

**157** EFFECT OF GAMMA RADIATION ON ION-EXCHANGE RESINS. V. The Kinetics of Irradiation Damage of Strong Base Functional Groups in the Anion-Exchange Resin Zerolit FF-IP. Litowska, M.; Basinski, A. (Univ., Torun, Poland). Nukleonika; 18: No. 5, 195-201(1973). (In Polish).

Investigations of radiation damage kinetics of strong base functional groups in the anion exchange resin Zerolit FF-IP, $Cl^-$ were carried out. It was found, that in the Zerolit investigated there are two kinds of strong base functional groups that differ from one another with respect to the radiation stability as well as to the mechanism of these groups disappearing. The decomposition of the groups showing great radiation stability belongs to the first order reaction, whereas the reaction of unstable groups disappearing is of the zero order. The data point to the significant participation of water radiolysis products in the radioinduced decomposition of the resin. (auth)

**158** RADIATION CHEMISTRY OF NITROGEN AND SULFUR HETEROCYCLICS. Berk, S.; Gisser, H. (Frankford Arsenal, Philadelphia). Radiat. Res.; 56: No. 1, 71-82(Oct 1973).

The γ radiolysis of nitrogen and sulfur heterocyclics having one or more nitrogen or sulfur atoms in five- and six-membered rings was studied. G values are given for the major gaseous products identified by gas chromatography for the radiolyses of pyrrole, pyrazole, imidazole, 1,2,4-triazole, tetrazole, pyrazine, pyrimidine, 1,3,5-triazine, benzotriazole, thiazole, isothiazole, and thiophene. The principal gaseous product formed during the γ-radiation of five- and six-membered nitrogen heterocyclics was hydrogen except that compounds having two adjacent nitrogen atoms in the ring produced large amounts of nitrogen and other gaseous products. When the N atoms are separated by carbon atoms, no nitrogen gas is produced and the G values for gas production are very low. Thiophene has greater stability to radiation than pyrrole as far as gas production is concerned. However, the introduction of a second heteroatom (nitrogen in the case of thiazole and isothiazole) in the five-membered ring containing sulfur (thiophene) does not change the radiosensitivity of the molecule. The nature of the free radicals formed by the irradiation of tetrazole at low doses ($1 \times 10^{18}$ eV/g) was studied by ESR. Radical species of at least two types are produced. (auth)

**159** SEMIEMPIRICAL STUDY OF THE SUGAR RADICALS IN IRRADIATED CYTIDYLIC ACID b AND DEOXYADENOSINE. Combs, L. L.; Holloman, M.; Young, J. K. (Mississippi State Univ., Mississippi State). Radiat. Res.; 56: No. 1, 8-20(Oct 1973).

The possible radical species resulting from irradiation of the sugar groups in deoxyadenosine and cytidylic acid b are studied by the semiempirical technique INDO. The calculated unpaired spin density and hyperfine coupling constants are compared with experimental data. These comparisons and calculated relative energeis of each species indicate that both molecules yield the same radical species upon irradiation. (auth)

**160** RADIATION CHEMISTRY OF AQUEOUS SOLUTIONS OF SIMPLE RCN COMPOUNDS. Draganic, I.; Draganic, Z.; Petkovic, L.; Nikolic, A. (Boris Kidric Inst. of Nuclear Science, Belgrade). J. Amer. Chem. Soc.; 95: No. 22, 7193-7199(31 Oct 1973).

The γ radiolysis of the following RCN compounds in aqueous solutions was studied at low doses (< 10 krads): hydrogen cyanide, acetonitrile, propionitrile, malononitrile, and succinonitrile. The radiolytic products $H_2$, $H_2O_2$, $NH_3$, aldehydes, $CO_2$, and $HNO_2$ were determined in degassed or oxygenated solutions at pH's 2 and 6. The cyano group was found to be the main target of attack by the primary free-radical products of irradiated water. Its behavior was considered by taking into account the free-radical model of water radiolysis and the radiation chemical yields measured under various experimental conditions. The following rate constants were determined in competition experiments: $k(H + HCN) = 3.6 \times 10^7\ M^{-1}\ sec^{-1}$, $k(e_{aq}^- + HCN) = 6.6 \times 10^8\ M^{-1}\ sec^{-1}$, $k(OH + HCN) \le 5 \times 10^7\ M^{-1}\ sec^{-1}$; $k(H + CH_3CN) = 3.5 \times 10^6\ M^{-1}\ sec^{-1}$, $k(e_{aq}^- + CH_3CN) = 2.5 \times 10^7\ M^{-1}\ sec^{-1}$, $k(OH + CH_3CN) = 5.5 \times 10^6\ M^{-1}\ sec^{-1}$; $k(H + C_2H_5CN) = 1.0 \times 10^7\ M^{-1}\ sec^{-1}$, $k(e_{aq}^- + C_2H_5CN) = 1.0 \times 10^8\ M^{-1}\ sec^{-1}$, $k(OH + C_2H_5CN) = 7.3 \times 10^7\ M^{-1}\ sec^{-1}$; $k(H + CH_2(CN)_2) = 1.6 \times 10^7\ M^{-1}\ sec^{-1}$, $k(e_{aq}^- + CH_2(CN)_2) = 7.1 \times 10^9\ M^{-1}\ sec^{-1}$; $k(H + (CH_2CN)_2) = 1.3 \times 10^7\ M^{-1}\ sec^{-1}$, $k(e_{aq}^- + (CH_2CN)_2) = 1.7 \times 10^9\ M^{-1}\ sec^{-1}$, $k(OH + (CH_2CN)_2) = 3.0 \times 10^7\ M^{-1}\ sec^{-1}$. The correlation between Taft's $\sigma^*$ function and measured rate constants of $e_{aq}^-$ + RCN reactions shows that the effect of the substituent R is mainly of the inductive type. (auth)

**161** γ-RADIOLYSIS OF PURE ACYL CHLORIDES AT 77°K: AN ELECTRON SPIN RESONANCE STUDY OF INTERMEDIATE RADICALS. Faucitano, A.; Martinotti, F. F. (Univ., Pavia, Italy). J. Chem. Soc., B; No. 11, 1563-1565(1973).

The matrix isolation technique, using ESR spectroscopy, was used to investigate the nature of free radical intermediates of the γ-radiolysis of polycrystalline linear and branched acyl chlorides at 77°K. The main radicals are accounted for in terms of C–H, OC–Cl, and C–COCl bond scissions and their relative abundance is significantly influenced by the chemical structure of the parent molecules. A mechanism is suggested. (auth)

**162** RADIATSIONNAYA OCHISTKA VODY. (Radiation Purification of Water). Dolin, P. I.; Shubin, V. N.; Brusentseva, S. A. Moscow; Izdatel'stvo Nauka (1973). 152p.

After an introduction to the radiolysis of water this study deals with the radiation oxidation of organic substances in aqueous solution, the effect of radiation on biodegradation, the radiation decolorization of water, and the removal of tastes and odors from water by irradiation. The oxidation of surface-active substances (mainly sulfonates), phenols, cyanides, dyestuffs, insecticides, lignins, and various organic wastes by radiation is reviewed. Radiation sources for water purification include: $^{60}$Co, $^{137}$Cs, fuel elements, reactor loops, fission product mixtures, and electron accelerators. Cost estimates are made for the use of these various radiation sources in purifying waste water. The book contains 8 tables, 28 illustrations and 121 literature citations. (SJR)

**163** RADIOLYSIS OF GASEOUS ETHYLENE, FORMATION OF PRIMARY RADICALS. Gawlowski, J.; Niedzielski, J. (Univ., Warsaw). Int. J. Radiat. Phys. Chem.; 5: No. 5, 419-430(Oct 1973).

Radiolysis of gaseous ethylene was investigated at ambient temperature and at −76°C, using the scavengers $NH_3$, $O_2$, $SF_6$, and iso-$C_4H_8$. Neutralization of positive ions was found to contribute to the formation of atomic hydrogen and methyl radical. There are two different mechanisms leading to the formation of $\cdot CH_3$, a pressure-dependent and a pressure-independent one. The pressure-dependent process, believed to be due to neutralization, involves two competitive steps: dissociation and collisional deactivation of excited species, resulting from neutralization. The $k_{deact}/k_{diss} = 1.5 \times 10^{-19}$ cm$^3$ molecule$^{-1}$, and $G_{CH_3} = 0.72$ (extrapolated to $p \rightarrow 0$) at −76°C. The pressure-independent process, probably due to a quick ion-molecule reaction, yields $G_{CH_3} = 0.61 \pm 0.02$. Neutralization of ions contributes $G_H = 2.9$ to the total yield of atomic hydrogen, which is $G_H \leq G_{C_2H_5} = 7.6$, at −76°C and 75 torr ($10^4$N m$^{-2}$). It was established that a part of the ethane ($G_{C_2H_6} \approx 0.25$) results from ion-molecule reactions, most probably of the $H_2$ transfer type. (auth)

**164** PULSE RADIOLYSIS OF $H_3PO_4$, $H_2PO_4^-$, $HPO_4^{2-}$, AND $P_2O_7^{4-}$ IN AQUEOUS SOLUTION. II. Spectra and Kinetics of the Intermediate Products. Grabner, G.; Getoff, N.; Schwoerer, F. (Max-Planck-Instituit fuer Kohlenforschung, Muelheim, Ger.). Int. J. Radiat. Phys. Chem.; 5: No. 5, 405-417(Oct 1973). (In German).

By pulse radiolysis of aqueous solutions of $H_3PO_4$, $H_2PO_4^-$, $HPO_4^{2-}$, and $P_2O_7^{4-}$ phosphate radicals formed by attack of OH, $O_{aq}^-$, and H were found. These radicals have characteristic absorption spectra with one band in the visible region ($\lambda_{max} = 500$ nm for orthophospates, $\lambda_{max} = 590$ nm for pyrophosphate) and another one in the uv region ($\lambda_{max} = 230$ nm). The molar absorption coefficients at 500 nm of the various forms of phosphate radicals have been determined: $\epsilon_{500}(H_2PO_4) = 23 \pm 4$ m$^2$ mole$^{-1}$, $\epsilon_{500}(HPO_4^-) = 72 \pm 12$ m$^2$ mole$^{-1}$, and $\epsilon_{500}(PO_4^{2-}) = 270 \pm 50$ m$^2$ mole$^{-1}$. The redetermination of the pK value for the equilibrium $HPO_4^- \rightleftharpoons PO_4^{2-} + H^+$ yielded $10.1 \pm 0.2$. On determining these quantities a strong dependence of the concentration of the phosphate radicals formed on the dose rate was found and considered. The kinetics of the 500 nm band was thoroughly reinvestigated and the following rate constants were determined: $2k(H_2PO_4 + H_2PO_4) = (2.5 \pm 0.5) \times 10^8$ dm$^3$ mole$^{-1}$ s$^{-1}$ at pH 3.8; $2k(HPO_4^- + HPO_4) \approx 1.4 \times 10^8$ dm$^3$ mole$^{-1}$ s$^{-1}$ (at $\mu = 0$); $2k(PO_4^{2-} + PO_4^{2-}) = (1.0 \pm 0.2) \times 10^8$ dm$^3$ mole$^{-1}$ s$^{-1}$ (at $\mu = 0$); $k(H_2PO_4 + H^+) \approx 2 \times 10^4$ dm$^3$ mole$^{-1}$ s$^{-1}$; and $k(PO_4^{2-} + OH^-) = (2.0 \pm 0.2) \times 10^5$ dm$^3$ mole$^{-1}$ s$^{-1}$ (at $\mu \approx 1$). (auth)

**165** PULSE RADIOLYSIS OF $H_3PO_4$, $H_2PO_4^-$, $HPO_4^{2-}$, AND $P_2O_7^{4-}$ IN AQUEOUS SOLUTION. I. Rate Constants for the Reactions with the Primary Products from the Radiolysis of Water. Grabner, G.; Getoff, N.; Schwoerer, F. (Max-Planck-Institut fuer Kohlenforschung, Muelheim, Ger.). Int. J. Radiat. Phys. Chem.; 5: No. 5, 393-403(Oct 1973). (In German).

The following rate constants were determined by means of pulse radiolysis of aqueous solutions of phosphoric acid and phosphates: $k(e_{aq}^- + H_2PO_4^-) = (6.6 \pm 0.8) \times 10^6$ dm$^3$/mole s, $\mu = 0$; $k(e_{aq}^- + HPO_4^{2-}) = (1.8 \pm 0.8) \times 10^4$ dm$^3$/mole s, $\mu = 0$; $k(e_{aq}^- + HP_2O_7^{3-}) = (1.1 \pm 0.3) \times 10^5$ dm$^3$/mole s, $\mu = 0$; $k(H + H_3PO_4) = (5 \pm 3) \times 10^5$ dm$^3$/mole s; $k(H + H_2PO_4^-) = (5 \pm 3) \times 10^5$ dm$^3$/mole s; $k(H + HPO_4^{2-}) < 5 \times 10^4$ dm$^3$/mole s; $k(OH + H_3PO_4) = (2.4 \pm 0.6) \times 10^6$ dm/mole s; $k(OH + H_2PO_4^-) = (2.0 \pm 0.5) \times 10^6$ dm$^3$/mole s; $k(OH + HPO_4^{2-}) = (7.9 \pm 0.4) \times 10^5$ dm$^3$/mole s; $k(OH + P_2O_7^{4-}) = (9 \pm 1) \times 10^5$ dm$^3$/mole s; and $k(O_{aq}^- + HPO_4^{2-}) = (2.4 \pm 1.2) \times 10^6$ dm$^3$/mole s, $\mu \approx 0.75$. At high phosphate concentrations also the direct radiolysis of the phosphate was observed: in a solution with 1 mole/dm$^3$ $H_2PO_4^-$, the G value for the process is $0.5 \pm 0.2$. The reactions listed above and the applicability of inorganic phosphates as buffering agents in radiation chemical and radiation biological systems are briefly discussed. (auth)

**166** PRODUCTION OF HEXACHLOROBUTADIENE PHOSPHOORGANIC BY-PRODUCTS. Drawe, H. (to Kernforschungsanlage Juelich GmbH). German Patent 1,937,577. 25 Feb 1971. Filed date 24 Jul 1969. (In German).

A process is described for the production of phosphoorganic derivatives of hexachlorobutadiene or similar compounds characterized by the fact that a mixture of hexachlorobutadiene and of known phosphites such as trimethyl phosphite or triethyl phosphite receives energy in the form of gamma radiation, ultraviolet light, or heat. Most of the nontransformed initial products are distilled in a known manner, and the residual product is fractionated according to a known method. (EJH)

**167** ABSORPTION SPECTRA OF SOLVATED ELECTRONS IN MONOETHANOLAMINE AND ETHANOL. Vannikov, A. V.; Marevtsev, V. S. (Inst. of Electrochemistry, Moscow). Int. J. Radiat. Phys. Chem.; 5: No. 5, 453-456(Oct 1973).

The absorption spectra of solvated electrons ($e_s^-$) were studied by pulse radiolysis in monoethanolamine (MEA) and ethanol (ETOH). It is found that both the structure of $e_s^-$ spectra and their position on the energy scale are determined in polar liquids mainly by the molecular structure of the liquids and not by their dielectric properties. (auth)

**168** PULSE RADIOLYSIS STUDIES ON COMPLEXES OF IRIDIUM. Broszkiewicz, R. K. (Inst. of Nuclear Research, Warsaw). J. Chem. Soc., Dalton Trans.; No. 17, 1799-1802 (1973).

Pulse irradiation of octahedral complexes $IrCl_6^{2-}$ and $IrCl_6^{3-}$ indicates that the former may be oxidized or reduced and the latter reduced without structural change occurring within a few μ s. The electron transfer reaction forms transient iridium (II) from iridium (III). Contrary to photochemical results irradiation does not promote aquation of the complexes in the early stages of reaction. The spectra, rate constants, and extinction coefficients of the discussed species were determined. (auth)

**169** QUANTITATIVE STUDY BY MOESSBAUER EFFECT OF THE RADIOLYSIS OF $Fe_2SO_4 \cdot 7H_2O$. Kellershohn, C.; Soubirou, F.; Hubert, C. (Hospital Necker-Enfants Malades, Paris). pp 29 of Hyperfine Interactions Detected by Nuclear Radiation. Liege; Univ. Liege (1973). (In French).

From Hyperfine Interactions Detected by Nuclear Radiation; Liege, Belgium (11 Sep 1973).

Irradiation by x rays of polycrystalline samples of $Fe_2SO_4 \cdot 7H_2O$ in the open air at ordinary temperature results in the formation of $Fe^{3+}$, probably in the form of ferric hydroxide according to chemical displacement and quadrupolar coupling provided by Moessbauer spectroscopy. Samples of 10 mg of Fe/cm$^2$ were irradiated by means of an x-ray tube under constant voltage of 50 kV. Spectra were produced at ordinary temperature by means of a constant acceleration spectrometer and from a $^{57}$Co−Pd source. The variation of the proportion of $Fe^{3+}$ as a function of the radiation dose is determined by comparison of the Moessbauer spectra from samples irradiated with those of standard mixtures of $Fe_2SO_4 \cdot 7H_2O$ and a hydroxide of iron having the same Moessbauer parameters as the $Fe^{3+}$ ion resulting from the irradiation. The amount of energy necessary for the production of a ferric ion starting with a molecule of $Fe_2SO_4 \cdot 7H_2O$ is deduced from experimental data and compared with that necessary to obtain the same effect on ferrous sulfate in aqueous solution. Some incidences of the results are discussed. (tr-auth)

**170** SPUR EFFECTS ON ELECTRON SCAVENGING IN AN IRRADIATED LOW TEMPERATURE GLASS. Moan, J.; Kaalhus, O. (Norsk Hydros Institutt for Kreftforskning, Oslo). Int. J. Radiat. Phys. Chem.; 5: No. 5, 441-451(Oct 1973).

Glassy samples containing various electron scavengers in glycol−water and sodium hydroxide matrices were exposed to x rays and uv light at 77°K, the latter causing ionizations by biphotonic absorption in tryptophan. Trapped electron yields were measured by ESR and optical absorption. The two types of irradiation might be expected to yield different values for the efficiencies of the scavengers because of the nonuniform x-ray production of electrons in spurs. Taking the experimental accuracy into account, such differences were not found, and possible explanations are suggested. The large spur effects found by other investigators are in contrast both to the experimental results and to a theoretical evaluation performed. Their results might be explained by effects of optical bleaching during uv irradiation. (auth)

**171** X-RADIOLYSIS ION YIELDS AND ELECTRON RANGES IN LIQUID XENON, KRYPTON, AND ARGON: EFFECT OF ELECTRIC FIELD STRENGTH. Robinson, M. G.; Freeman, G. R. (Univ. of Alberta, Edmonton). Can. J. Chem.; 51: No. 5, 641-649 (1 Mar 1973).

X-radiolysis ion yields were measured at electric fields between 1 and 60 kV/cm in argon at 87°K, krypton at 148°K, and xenon at 183°K. The results were analyzed according to a theoretical model to obtain the total ion yields $G_{tot}$, the free ion yields at zero field strength $G_{fi}^0$ and the most probable penetration ranges b of the secondary electrons in the liquids. The respective values were: Ar, 7.3, 2.9, 1330 Å; Kr, 13.0, 5.8, 880 Å; Xe, 13.7, 7.0, 720 Å. The total ionization yields in these substances are greater in the liquid than in the gas phase, probably due to smaller ionization potentials in the condensed phase (polarization energy effect). Field dependent electron mobilities are also reported. (auth)

**172** KINETICS OF QUASIFREE ELECTRON REACTIONS IN THE LIQUIDS METHANE, KRYPTON, AND XENON. Robinson, M. G.; Freeman, G. R. (Univ. of Alberta, Edmonton). Can. J. Chem.; 51: No. 5, 650-655(1 Mar 1973).

The encounter efficiency of $e^- + N_2O \rightarrow N_2O$ in the liquids methane, krypton, and xenon at 183°K is $f \approx 10^{-5}$. The parameter β, for the nonhomogeneous kinetics of reactions in γ radiolysis spurs in the liquids, has values similar to those ($10^{13}$ to $10^{14}$ V/cm$^2$) obtained earlier for liquids such as cyclohexane, methanol, and water at

298°K, in which f is approximately unity. Previous results for nitrous oxide in neopentane at 296°K have been reinterpreted to obtain f ≈ $10^{-2}$. For solvents in which the electron mobility is very high (~$10^3 cm^2/Vs$) the value of f is low. As the electron mobility decreases f increases to a maximum of unity. (auth)

**173** CHARGE SCAVENGING BY BENZENE IN γ-IRRADIATED LIQUID CYCLOHEXANE. Kennedy, M. G.; Stone, J. A. (Queen's Univ., Kingston, Ont.). Can. J. Chem.; 51: No. 1, 149-151(1 Jan 1973).

The effect of benzene on the yield of propane formed by $H_2$ transfer to cyclopropane in γ-irradiated liquid cyclohexane was used to determine the efficiency of cation scavenging by benzene. The reduction of the hydrogen yield from cyclohexane by the addition of low concentrations of benzene may be accounted for by a combination of cation and H atom scavenging. G(benzene in polymer) found in previous studies correlates well with G(H atoms scavenged). (auth)

**174** 1-PROPANETHIOL AS A RADICAL SCAVENGER IN THE γ-RADIOLYSIS OF LIQUID CYCLOHEXANE. Essor, J.; Stone, J. A. (Queen's Univ., Kingston, Ont.). Can. J. Chem.; 51: No. 2, 192-197(15 Jan 1973).

1-Propanethiol is an excellent H atom and alkyl radical scavenger in the γ radiolysis of liquid cyclohexane. The total radical yield (5.2) is measured by twice the yield of propyl disulfide which appears to be invariant with propanethiol concentration. 1-Propanethiol-d is about as efficient an H atom scavenger as ethylene. $C_3H_7S$ radicals add reversibly to cyclohexene. (auth)

**175** HIGH-DOSE-RATE RADIOLYSIS OF $H_2S$: SULFUR IS AN ELECTRON SCAVENGER. Boyd, A. W.; Willis, C.; Miller, O. A. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Chem.; 51: No. 8, 1228-1234(15 Apr 1973).

The radiolysis of gaseous hydrogen sulfide by high-energy electrons was studied in the presence of added sulfur at 200 to 250°C. At $2 \times 10^{27}$ eV $g^{-1}$ $s^{-1}$ sulfur reduces the hydrogen yield from $G(H_2) = 12.0 \pm 0.3$ to $G(H_2) = 7.3 \pm 0.3$. This reduction in yield appears to be due to electron attachment by the sulfur thereby suppressing formation of hydrogen from dissociative neutralization. Assuming the sulfur is $S_8$ the attachment rate of electrons to sulfur is estimated to be about $1 \times 10^{14}$ $M^{-1}$ $s^{-1}$. At 25°C the reduction in the $H_2$ yield at $2 \times 10^{27}$eV $g^{-1}$ $s^{-1}$ with increasing dose appears to be due to polysulfanes rather than radiolytic sulfur. Over the range of $10^{26}$ to $10^{28}$ eV $g^{-1}$ $s^{-1}$ the $H_2$ yield increases from $G(H_2) = 11$ to $G(H_2) = 13$. Mechanisms to account for this increase are discussed. (auth)

**176** RADIATION-CHEMICAL MODIFICATION OF LIGNIN USING BINARY MIXTURES OF MONOMERS. Pormale, M. Ya.; Kashkina, N. A.; Surna, Ya. A. (Inst. of Chemistry of Lignin, Riga). Khim. Drev.; No. 5, 109-113(1970). (In Russian).

The effect of the addition of vinyl acetate (5 to 50%), initiator of radical polymerization (benzoyl peroxide at 0.1 to 0.2%), and of radiation doses of 5 to 15 Mrad on the styrol conversion during the radiochemical modification of lignin was studied. It was shown that the addition to the styrol of small quantities of vinyl acetate sharply increases the conversion of the monomer. The addition of 5 to 10% of vinyl acetate to the styrol decreases the optimum radiation dose by 2.5 times. During radiochemical modification of birch lignin using binary mixtures of monomers materials were obtained with dimensional stability in the radial and tangential direction (about 4 times) and decreased water absorption (approximately 5 times) in comparison with controls of lignin samples. (tr-auth)

**177** MONOMER POLYMERIZATION IN LIGNIN. V. Microscopical Study of the Swelling in Water of Radiation-Chemically Modified Birch Wood. Katkevich, Yu. Yu.; Alksnis, A. F.; Pendere, M. K. (Inst. of Chemistry of Lignin, Riga). Khim. Drev.; No. 5, 133-138(1970). (In Russian).

The swelling in water of libriform fibers and their membranes in samples of radiation modified birch lignin was studied. The samples were irradiated with γ rays (integral dose of 25 Mrad with an intensity of 70 rad/sec). Under the irradiation one part of the completely dried sample was impregnated with styrol, another with a mixture of styrol and methanol in the ratio of 1:1, and a third was impregnated with nothing. The data obtained showed that in samples impregnated with mixtures of styrol and methanol an increase of the thickness of the samples took place which can be explained by the polymerization of the styrol in the membranes, but in samples impregnated with only styrol an increase of the thickness of the membranes was not detected and there was no increase in the incorporated styrol or its quantity was insignificant. The membranes of the samples, impregnated with styrol, did not differ with respect to swelling in water from membranes of unimpregnated samples, but in samples impregnated with mixtures of styrol and methanol, the swelling of the membranes in water was insignificant (3 to 5%) which can be explained by the presence of free hydroxyl groups on the internal surface of the modified lignins. (tr-auth)

**178** INFLUENCE OF THE POLYMER DISTRIBUTION ON THE SWELLING ABILITY OF RADIATION-CHEMICALLY MODIFIED WOOD. Erin'sh, P. P. (Inst. of Chemistry of Lignin, Riga). Khim. Drev.; No. 6, 19-27(1970). (In Russian).

Radio-chemically modified lignin was obtained by means of treatment with styrol and methyl metacrylate. Different impregnation processes were used; the polymer was measured out in different proportions in the cell voids and walls of the lignin. It was shown that the form stability of the lignin is determined by the quantity of the polymer found in the cell walls. The polymer which is found in the cell voids decreases the water absorption and the swelling rate of the modified lignin in water. The larger the volume of the lignin is increased during the modification the smaller it swells in water. It was assumed that during radiochemical modification by means of the grafting with styrol and methyl metacrylate it is impossible to get complete form stability of the lignin; because of the free hydroxyl groups of the lignin the swelling capacity is kept to 3 to 4%. It was also assumed that the quantity of grafted polymer during the radiation polymerization depends on the size of the internal surface of the lignin accessible to monomer molecules. (tr-auth)

**179** SOME INVESTIGATIONS OF THE RADIATION-CHEMICAL MODIFICATION OF LIGNIN. Alksnis, A. F.; Surna, Ya. A.; Indane, M. K.; Rasinya, R. A.; Landsberga, M. M. (Inst. of Chemistry of Lignin, Riga). Khim. Drev.; No. 5, 115-118(1970). (In Russian).

The character of the bonds of the polystyrol in birch lignin impregnated with styrol after γ irradiation was studied. After extraction of the free polymer with benzene from the residue dioxane lignin was precipitated. The dioxane solution was turbidimetrically titrated with water. The dioxane lignin was also subjected to oxidation by peracetic acid as a result of which the lignin–polystyrol bond was destroyed and the polymer grafting was determined quantitatively. It was established that during the polymerization of the styrol in the lignin, chemical bonds between the polystyrol and the lignin were formed. (tr-auth)

**180** DYNAMICS OF SOLVATION OF AN EXCESS ELECTRON. Rentzepis, P. M. (Bell Telephone Labs., Murray Hill, NJ); Jones, R. P.; Jortner, J. J. Chem. Phys.; 59: No. 2, 766-773(15 Jul 1973).

The techniques of picosecond spectroscopy were utilized to study the localization of an excess electron in water. Quasifree electrons were generated by the photoionization of the ferrocyanide anion in aqueous solutions at 2650 Å. Time resolved absorption of the localized electron was monitored continuously from 1.06 μ to 5300 Å, while time and energy resolved absorption was monitored in the range 3100 to 9000 Å by a broad continuum of picosecond duration. Optical absorption of the initially localized electron in the infrared (1.06 μ) is observed within 2 psec after the generation of the quasifree electron. The optical absorption band evolves in time, shifting from lower to higher energies, and the "normal" absorption of the hydrated electron is developed in ~4 psec. (auth)

**181** TRANSIENT SPECIES FROM THE REACTION OF THE HYDRATED ELECTRON WITH HEXACYANOCOBALTATE. III. Mihalcea, G. (Univ., Bucharest); Hentz, R. R. Rev. Roum. Chim.; 18: No. 9, 1577-1580(1973).

The nanosecond pulsed electron radiolysis of aqueous solutions of hexacyanocobaltate(III) was investigated. The results of this work indicate that $e^-_{aq}$ and $Co(CN)_6^{3-}$ react with $k = (3.3 \pm 0.1)10^9$ $M^{-1}$ $sec^{-1}$ to give one transient species (with $\epsilon_{max} = 4 \times 10^3 M^{-1}$ $cm^{-1}$ at 280 nm) which decays with $t_{1/2} = 10.4 \pm 0.4$ μsec. (auth)

**182** RADIOLYSIS OF TERTIARY BUTYL ALCOHOL AT 77°K. Tikhomirov, L. A. (Inst. of Chemical Physics, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 7: No. 3, 219-223 (1973).

Translated from Khim. Vys. Energ.; 7: No. 3, 246-251(1973).

The kinetics were studied for the radiolysis of tertiary butyl alcohol at 77°K at doses up to 235 Mrad. It was found, by the EPR method, that the radicals $\dot{C}H_2(CH_3)_2COH$, $(CH_3)_2\dot{C}OH$, and $(CH_3)_3\dot{C}$ are stabilized in the irradiated tertiary butanol. The accumulation of radicals takes place with a radiation yield of 1, 0.2 to 0.4, and 0.2 to 0.4 and the limiting concentrations reach values of $2 \times 10^{19}$, $5 \times 10^{18}$, and $5 \times 10^{18}$ $g^{-1}$, respectively. The stable radiolysis products are $CH_4$, $H_2$, $C_2H_6$, iso-$C_4H_8$, and $CH_3COCH_3$. The methane, acetone, and ethane yields increase with increasing dose and the hydrogen and isobutylene yields, conversely, decrease. It was concluded, on the basis of the experimental data obtained, that acetone and methane, with a yield equal to ~1, are formed by means of a molecular rupture reaction. The increase in the methane and acetone yields with the dose is considered to be the result of the decomposition of the alcohol radicals into $\dot{C}H_3$ and acetone. It is suggested that the decrease in the hydrogen yield with an increase in the dose yield takes place because of the reaction with the $\dot{C}H_3$ radicals and, for isobutylene, because of the capture of charges by radicals. (auth)

**183** KINETICS FOR THE SYNTHESIS OF $NF_3$ AND $N_2F_2$ FROM A MIXTURE OF $N_2 + F_2$ GASES UNDER THE ACTION OF FAST ELECTRONS. Dmitrievskii, V. A.; Cherednikov, V. N.; Il'in, E. K. High Energy Chem. (USSR) (Engl. Transl.); 7: No. 3, 184-187(1973).

Translated from Khim. Vys. Energ.; 7: No. 3, 206-210(1973).

The radiolysis was studied of a mixture of gases, $N_2 + F_2$ under the action of fast electrons having an energy of ~30 MeV. It was shown that the products are nitrogen trifluoride and difluorodiazine isomers. The values were determined of the radiation yields and the dependences were found of the rate of synthesis of the products on the starting pressure and composition of the gas mixture, the dose, and strength of the radiation dose, and also the temperature of the ampule's wall. The stationary concentrations reached ~42% for $NF_3$ and ~1.5% for $N_2F_2$. (auth)

**184** CARBOXYLATION OF METHANOL UNDER THE ACTION OF THE γ RADIATION OF $^{60}$Co. Kapustin, I. A.; Gergalov, V. I.; Zhigunov, I. S.; Kanash, V. A.; Petryaev, E. P. (Inst. of Nuclear Energetics, Minsk). High Energy Chem. (USSR) (Engl. Transl.); 7: No. 3, 224-226(1973).

Translated from Khim. Vys. Energ.; 7: No. 3, 252-255(1973).

The influence of the absorbed dose and the concentration of methanol on the yields of the radiolysis products at a constant content of carbon dioxide in the liquid phase was studied at room temperature. The kinetics of the accumulation of glycolic acid, ethylene glycol, formaldehyde, and hydrogen was investigated by methods of photocolorimetry and gas chromatography. The insufficiency of the previously proposed mechanism of the formation of glycolic acid, the basic product of radiation chemical carboxylation of $CH_3OH$, was demonstrated. An explanation was proposed for the dependence obtained on the basis of concepts of the participation of excited water molecules in the process. (auth)

**185** ROLE OF THE IONS IN THE RADIATION POLYMERIZATION MECHANISM OF VINYL CHLORIDE IN THE GAS PHASE. III. Investigation of the Dependence of the Polymer Yield on the Electric Field Intensity. Volkov, N. G.; Gorbachenko, G. M.; Deev, Yu. S.; Lyapidevskii, V. K. (Moscow Engineering Physics Inst.). High Energy Chem. (USSR) (Engl. Transl.); 7: No. 3, 227-230(1973).

Translated from Khim. Vys. Energ.; 7: No. 3, 256-260(1973).

The dependence of the poly(vinylchloride) yield on the electric field intensity was investigated. A comparison of the yield with the number of ion–ion recombinations and with the average concentration of the ions calculated for the same conditions permits one to assume that the initiation of the polymerization is accomplished with the radicals formed as a result of the ion–ion recombinations. (auth)

**186** ESR AND CALORIMETRIC INVESTIGATION OF THE FREE RADICALS IN METHANOLIC $CoCl_2$ AND $MnCl_2 \cdot 2H_2O$ SOLUTIONS IRRADIATED AT 77°K. Abdrashitov, E. F.; Kiryukhin, D. P.; Tikhomirov, L. A.; Barkalov, I. M. (Inst. of Chemical Physics, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 7: No. 3, 243-245(1973).

Translated from Khim. Vys. Energ.; 7: No. 3, 274-276(1973).

Methanolic $CoCl_2$ and $MnCl_2 \cdot 2H_2O$ solutions were irradiated at 77°K by γ rays and the limiting concentration of the radicals formed was measured by ESR and by the heat release as a result of the recombination of the radicals as the irradiated solution thaws. All the solutions investigated pass into a glassy state when the freezing rates are 20 to 50 deg/min. A gradual change in the heat capacity at 110 to 120°K, which is characteristic for the transition of a substance from the glassy state to a supercooled liquid, is observed on the calorimetric thawing curve of such a system. With a further increase in temperature, an exothermic peak due to crystallization at 140 to 150°K and then melting (158°K) are observed. It was concluded on the basis of ESR measurements that the transition metal ions increase the radiation stability of the matrix. (DHM)

**187** INFLUENCE OF AN ADDITION OF CARBONATE ION ON THE POST-RADIATION ANNEALING OF PROTON-IRRADIATED CESIUM NITRATE. Eremin, L. P. (Tomsk Polytechnic Inst., USSR). High Energy Chem. (USSR) (Engl. Transl.); 7: No. 3, 253-254(1973).

Translated from Khim. Vys. Energ.; 7: No. 3, 280-281(1973).

The influence of an anionic additive on the postradiation annealing of nitrates was studied using $CsNO_3$ as an example. Results show that the amount of annealable products in pure $CsNO_3$, just as in alkali metal nitrates without additives and with an additive of divalent cations, approaches saturation as the dose irradiation is increased. The introduction of an addition of $CO_3^{2-}$ into $CsNO_3$ leads to a change in the nature of the annealing in comparison with annealing in pure $CsNO_3$ and in nitrates with cationic additives. This is expressed by the fact that annealing, detectable by chemical analysis, is observed only after a dose of more than 50 Mrads. A scheme is suggested for the annealing of $CsNO_3$ with an additive of $CO_3^{2-}$ based on the radiolysis products NO, $NO_2$, $O_2^-$, and $O_3^-$. (DHM)

**188** EFFECT OF IRRADIATION TEMPERATURE ON THE CHARACTER OF THE RADIATION CROSS-LINKING OF BUTADIENE–STYRENE RUBBERS PREPARED BY THE EMULSION POLYMERIZATION METHOD. Sobolev, V. S.; Zaides, N. L.; Klauzen, N. A. High Energy Chem. (USSR) (Engl. Transl.); 7: No. 3, 257-258(1973).

Translated from Khim. Vys. Energ.; 7: No. 3, 283-285(1973).

A study is reported of radiation crosslinking of rubbers containing 10% styrene (SKS-10ARK) and 25% styrene (Yuropren 1500) and for comparison a rubber containing no styrene (SKDpl). The relative change in crosslinking yield, $G_c$, and degradation yield, $G_D$, when the irradiation temperature was raised from 25 to 100°C ($G_c^{100}/G_c^{25}$; $G_D^{100}/G_D^{25}$) and to 160°C ($G_c^{160}/G_c^{25}$; $G_D^{160}/G_D^{25}$) is given. The change in double bond content was estimated both when the rubbers had received doses of 30 MRad and also when an identical network density had been attained at irradiation temperatures of 25 and 160°C. (DHM)

**189** THEORETICAL EVIDENCE FOR A STABLE FORM OF CYCLIC OZONE AND ITS CHEMICAL CONSEQUENCES. Wright, J. S. (Carleton Univ., Ottawa). Can. J. Chem.; 51: No. 1, 139-146(1 Jan 1973).

The total energy of the symmetrical, bent $O_3$, molecule is studied as a function of internuclear angle and internuclear distance. The method used is an ab initio molecular orbital calculation with a minimum basis set of Slater-type orbitals, plus limited configuration interaction. Best single configuration energies show the existence of two stable minima: a cyclic (60°) structure and a bent (115°) structure. The cyclic structure is preferred by 48 kcal/mol, contrary to experiment (116°48′). Configuration interaction results with two low lying orbitals show the cyclic form still preferred by 6 kcal/mol. A transition state for the bent-cyclic pathway lies 26 kcal/mol (or less) above the bent form. Based on these results, a possible low energy path via the cyclic form is proposed for the thermal decomposition of ozone. It is also proposed that cyclic ozone may have been observed in the pulse radiolysis of oxygen. (auth)

**190** RADICAL PAIRS IN IRRADIATED SINGLE CRYSTALS OF 1-METHYLURACIL. Dulcic, A.; Herak, J. N. (Institut Rudjer Boskovic, Zagreb). Mol. Phys.; 26: No. 3, 605-614(Sep 1973).

Irradiated single crystals of 1-methyluracil exhibit the presence of several types of radical pairs. Three of them were identified. Each pair is composed of a hydrogen-abstraction and a hydrogen-addition radical. The calculations performed show that the postulation of a very strong exchange interaction is not necessary for the existence of the triplet state, if only the sufficiently large dipole–dipole interaction is present. On the basis of the experimental findings the mechanism of the radical formation is discussed. The relevance of that mechanism for the damaging process of DNA is also indicated. (auth)

**191** EFFECT OF GAMMA RADIATION ON SOME ORGANIC pH INDICATORS. Zittel, H. E. (Oak Ridge National Lab., TN). J. Radioanal. Chem.; 14: No. 1, 19-28(Mar 1973).

The effect of γ-radiation on the color intensity of a series of representative organic dyes, commonly used as pH indicators, was studied. In aqueous medium, at commonly used concentration levels, the dyes demonstrate ability to indicate pH after γ-doses of $10^3$ to $10^4$ R. In general all the dyes show less sensitivity to radiation in neutral or basic media than in acid media. The compounds demonstrate a pseudo first order degradation reaction rate which was shown to be the expected radiation effect zero order rate. Of those compounds studied, methyl orange proved to be the most sensitive to radiation while bromocresol green is the most resistant to radiation damage. It was found that addition of small amounts of ethyl alcohol to the medium was effective in decreasing dye radiation damage to a large degree. (auth)

**192** THERMOLUMINESCENCE OF NUCLEIC ACID CONSTITUENTS IN THE SOLID STATE. Jelinek, O.; Pospisil, J. (Charles Univ., Prague). Stud. Biophys.; 36-37: 21-27(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

The low temperature glow curves of bases of nucleic acids are presented after the excitation with uv light or x-rays. In the case of adenine there is a homogeneous distribution of trapping levels till 0.36 eV causing both thermoluminescence and long lived luminescence with the decay law $I \sim t^{-1}$ which is entirely independent of temperature till 150° K. (auth)

**193** REACTIONS BETWEEN NITROXYLS AND RADIATION-INDUCED LONG-LIVED DNA TRANSIENTS. Brustad, T.; Jones, W. B. G.; Wold, E. (Norsk Hydros Institutt for Kreftforskning, Oslo). Int. J. Radiat. Biol.; 24: No. 1, 33-43(Jul 1973).

The reactions of the organic nitroxyle free radical 2, 2, 6, 6-tetramethyl-4-piperidone-N-oxyl (TAN) with radiation-induced DNA transients were studied under anoxic conditions by means of a special irradiation-mixing technique. Unirradiated $^3$H-TAN ($2x\ 10^{-5}$ M in $10^2$ M NaCl) was mixed in proportion 1:1 with irradiated DNA (1 mg/ml in $10^{-2}$ M NaCl) at predetermined times (t) after irradiation from a 4-MeV electron accelerator, with $t > 20$ sec. After irradiation and mixing, the per cent loss of TAN spins ($N_{SL}$) was determined by an ESR technique, and the per cent $^3$H-TAN bound to DNA ($N_B$) was determined by column chromatography. The data show that TAN interacts with radiation-induced DNA transients in two different ways: DNA + TAN → (DNA-TAN) complex where DNA are free radicals and the (DNA-TAN) complexes are void of TAN spins, and $DNA_{tr}$ + TAN → $DNA_1^+$ + $TAN^-$. The latter reaction involves electron transfer from radiation-induced DNA transients ($DNA_{tr}$) to TAN, yielding reduced TAN and DNA derivative ($DNA_1^+$). The data show that $N_{SL}/N_B \approx 2.5$ when 20 sec < t < 40 min. About the same ratio was found when anoxic TAN and DNA were mixed before irradiation. It has been shown by pulse radiolysis that radiation-induced DNA transients with a pronounced absorption maximum near 310 nm are formed. For t < 3 min, this transient appears to have decay properties comparable to those of the transients participating in complex-formation and electron-transfer reactions. The life-span of radiation-induced DNA transients is shown to be highly sensitive to the presence of trace amounts of oxygen, which in $N_2$-saturated solution may affect the yield of reduced TAN more than that of complex formation. (auth)

**194** RADIOLYSIS OF SOME INORGANIC COMPOUNDS LABELED WITH $^3$H. Thiemt, K. (Technische Univ., Dresden). Isotopenpraxis; 9: No. 4, 127-131(Apr 1973). (In German).

The $G(H_2^{\ddagger})$ values of aqueous tritiated solution autoradiolysis were determined by means of a gas-counter assembly. Time dependence and dependence of radiolysis on specific $H_2^{\ddagger}O$ activity were investigated. Furthermore, the behavior of labelled hydrochloric acid and soda lye of various concentrations and specific activities under tritium beta radiation were observed. Various salts, such as $FeCl_2$, $FeCl_3$, $ZnCl_2$, $Zn(NO_3)_2$, and others were added to the solution in order to find out if hydrogen formation can be partially suppressed by radiolysis without simultaneous reduction of the hydrogen quantity formed through the samples under investigation. (auth)

**195** CHEMICAL EFFECTS ASSOCIATED WITH THE REACTOR IRRADIATION OF 2,2-BIPYRIDYL. Barakat, M. F.; Abdelkerim, F. M.; Abdelghany, M. (Atomic Energy Authority, Cairo). Isotopenpraxis; 9: No. 6, 216-219(Jun 1973).

The chemical changes occurring in reactor irradiated 2,2-bipyridyl were studied and compared with the changes occurring in some other solid and liquid systems in a trial to identify some reaction mechanisms and their dependence on phase and structure of the irradiated molecules. Particular consideration was directed to the polymeric products formed containing the major fraction of radiocarbon generated in the irradiated samples. The results obtained in bipyridyl as well as in some other irradiated solid systems showed that the "random fragmentation hypothesis" of J. E. Willard offers the adequate explanation of many of the reactions taking place in irradiated solid organic systems. (auth)

**196** RADIOLYSIS OF TRIVALENT ANTIMONY IN HYDROCHLORIC ACID SOLUTIONS CONTAINING ORGANIC ADDITIVES. Souka, N.; Haggag, A. (Atomic Energy Establishment, Inshas, Egypt). Isotopenpraxis; 9: No. 6, 220-223(Jun 1973).

The γ radiolysis of antimony in hydrochloric acid solutions containing different organic additives was investigated. The effect of these additives on the oxidation yield is discussed. A mechanism of induced oxidation of Sb(III) is suggested based on experimental data. (auth)

**197** POSTPOLYMERIZATION OF GAMMA-IRRADIATED FORMALDEHYDE AT 20 TO 150°K. Kiryukhin, D. P.; Kaplan, A. M.; Barkalov, I. M.; Gol'danskii, V. I. (Inst. of Chemical Physics, Moscow). Dokl. Akad. Nauk SSSR; 211: No. 3, 632-635(21 Jul 1973). (In Russian).

A calorimetric method suitable for use at liquid helium temperatures was used for low-temperature studies of post-irradiation polymerization of formaldehyde. Chain polymerization of formaldehyde was demonstrated at 15-20°K. The rate of heat release increased with temperature, then decreased, again increased to the melting point of formaldehyde, and then dropped to zero. The temperatures of the first rise and fall depended on the radiation dose. The effect of optical bleaching differed in the two fields, polymerization being more effectively depressed in the first field. The course of postpolymerization at low temperatures (20-70°K) apparently is governed by the presence of stabilized ions. At higher temperatures, the process is governed by radical formation. (TTT)

## Radiochemistry and Nuclear Chemistry

**198** MECHANISM OF RADIOLUMINESCENCE IN ALIPHATIC SOLVENTS. Andreeshchev, E. A.; Kilin, S. F.; Spurni, F. (State Committee on Utilization of Atomic Energy, Sukhumi, USSR). Int. J. Radiat. Phys. Chem.; No. 5, 431-440(Oct 1973). (In Russian).

The radiochemical yields of excited states of luminescent additives with positive (diphenyloxazole, triphenylpyrazoline) and negative (benzol) affinities towards the electron, and quenching of radioluminescence of these systems in presence of $CCl_4$ were measured in cyclohexane and hexane solutions. In solutions containing luminescent additives with positive electron affinity, the excited state yields are larger, while quenching by $CCl_4$ is weaker. The curves of radioluminescence decay were measured. The duration of energy transfer from the solvent to the luminescent additive is less than $5 \times 10^{-10}$ s. Quantum yields of energy transfer in solutions photoexcited by $\lambda = 1608$ Å and $\lambda = 1215$ Å were measured too. The results obtained can be interpreted assuming that a part of the excited states of the luminescent additives results from charge transfer to the luminescent additive and subsequent recombination, the rest being obtained as a result of excitation energy transfer to the luminescent additive. In the case of high concentrations of luminescent additives the main way of generating excited states is the recombination, while in the case of small concentrations it is due to the excitation transfer. (auth)

**199** NUCLEAR CHEMISTRY. pp 611-634 of Chemie. Das Basiswissen der Chemie in Schwerpunkten. Mortimer, C. E. Stuttgart; Thieme (1973). (In German).

The chapter "nuclear chemistry" of Mortimer's chemistry text-book gives a brief general introduction of the fundamentals of nuclear and radiochemistry. The following aspects are treated: the structure of the atomic nucleus, the nature of the radioactivity and the kinetics of radioactive decay, the radioactive series, nuclear reactions with fission and fusion included, some examples of the application of radionuclides. Some exercises on the discussed phenomena close the introduction. (GE)

### Hot-Atom Chemistry

**200** (COO-1713-43) REACTION STUDIES OF HOT SILICON AND GERMANIUM RADICALS. Progress Report, September 1, 1972–August 31, 1973. Gaspar, P. P. (Washington Univ., St. Louis, Mo. Dept. of Chemistry). 1973. Contract AT(11-1)-1713. 26p. Dep. NTIS $3.50.

Progress was made in the following major areas: a. primary reactions of recoiling silicon atoms and the mode of formation of silylene; b. elucidation of the role of ionic reactions in the chemistry of recoiling silicon atoms; c. kinetics of addition of silyl radicals to olefins; d. flow-discharge kinetic measurements of the rates of reaction of $^2P_{3/2}$ and $^2P_{1/2}$ chlorine atoms with saturated and unsaturated substrates. (auth)

### Properties of Radioactive Materials

*Refer also to abstracts 81, 110, 218, 899, and 1666.*

**201** (AEC-tr-7474) COMPLEXING TRIVALENT AMERICIUM, CURIUM, CALIFORNIUM, PROMETHIUM, AND YTTRIUM IONS WITH BIS(HYDROXYMETHYL PHOSPHINIC) ACID. Vorob'eva, V. V.; Elesin, A. A.; Zaitsev, A. A. (Scientific Research Inst. of Atomic Reactors, Dimitrovgrad (USSR)). 1973. Translation of SRARI-P-185. 9p. Dep. NTIS $3.00.

The dissociation constant was determined for bis(hydroxymethyl) phosphinic acid DOMPA (pK = 2.08 at the ionic strength $\mu = 0$, t = 25°C). In addition, compositions and stability constants for $Am^{3+}$, $Cm^{3+}$, $Cf^{3+}$, $Pm^{3+}$, and $Y^{3+}$ complexes were determined by ion exchange on cationite at $\mu = 0.2$ and t = 25°C. The complexes $MA^{2+}$ and $MA_2^+$ are shown to be formed with the stability constants

Cf$\beta_1$ = (1.8 ± 0.1)·$10^2$; $\beta_2$ = (8.36 ± 0.67)·$10^3$; Pm$\beta_1$ = (8.5 ± 0.6)·$10^1$; $\beta_2$ = (5.58 ± 0.05)·$10^{3-}$; Cm$\beta_1$ = (7.3 ± 1.2)·$10^1$; $\beta_2$ = (3.95 ± 0.29)·$10^{3-}$; Am$\beta_1$ = (5.1 ± 0.7)·$10^1$; $\beta_2$ = (3.08 ± 0.17)·$10^3$; Y$\beta_1$ = (4.2 ± 0.5)·$10^1$; $\beta_2$ = (2.48 ± 0.13)·$10^3$. These constants were used in calculation of the process of separation on cationite with $\mu = 0.5$, DOMPA concentration = 0.3 and pH = 2.5. The dynamic experiments showed good agreement with calculational results. (auth)

**202** (CONF-730927-2) STUDIES ON THE CHEMICAL AND COLLOIDAL NATURE OF Pu(IV) POLYMER. Lloyd, M. H.; Haire, R. G. (Oak Ridge National Lab., Tenn. (USA); Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). [nd]. 19p. Dep. NTIS $3.00.

From twenty-fourth congress of the International Union of Pure and Applied Chemistry; Hamburg, F. R. Germany (3 Sep 1973).

Spectrophotometric, x-ray, electron diffraction, and electron microscopy studies of plutonium polymer are reported. Results indicate that the polymer consists of very small discrete particles, which can be either amorphous or crystalline, and which can be colloidally dispersed in a suitable medium such as dilute HCl or $HNO_3$. Results also indicate that a monomeric Pu(IV) hydroxide species is not formed during initial precipitation as has been previously reported, but instead small crystallites of hydrated $PuO_2$. (JGB)

**203** (ORNL-tr-2728) CHEMICAL SEPARATION OF KURCHATOVIUM. Zvara, I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1971. Translation by M. Gerrard of JINR-D7-5769. 2p. Dep. NTIS $3.00.

Results of a series of experiments, beginning in 1966, on the identification and chemistry of kurchatovium (element 104) are reviewed. Recently experiments were conducted that permitted more selective separation of element 104 from interfering activities. Results agreed with those from previous investigations. (JGB)

**204** PROPERTIES OF RADIOACTIVE TRACERS APPLIED IN INVESTIGATIONS OF PETROL DISTILLATION PROCESS. Graczyk, J. Nukleonika; 18: No. 7, 315-324(1973). (In Polish).

Criteria for selection of radioactive tracers in investigations of petrol distillation process are discussed. Distillation characteristics, effectiveness of purification methods and effective radiochemical purity of the tracers (tetraethylgermanium and bromobenzene activated in nuclear reactor, $C_6H_5{}^{82}Br$ and n-$C_4H_9{}^{82}Br$ synthesized) were determined. (auth)

**205** DIAGRAMS OF POTENTIAL/$PO^{2-}$ FOR Np AND Pu IN THE LiCl−KCl EUTECTIC. Duyckaerts, G.; Martinot, L. (Univ., Leige). Anal. Chim. Acta; 66: No. 3, 474-476(Oct 1973). (In French).

The diagrams were established at 400°C. At that temperature, Np is present in the 3+, 4+, and 5+ oxidation states, Pu in the 3+ and 4+ oxidation states. The diagrams are compared with that of the uranyl ion. (JGB)

**206** KINETICS AND MECHANISMS OF TITANIUM(III) REDUCTIONS OF VANADIUM(V) AND URANIUM(VI) IN AQUEOUS ACIDIC SOLUTION. Logan, T. P. Philadelphia; Univ. of Pennsylvania (1973). 119p. University Microfilms Order No. 73-24,176.

Thesis (Ph. D.).

The reaction between Ti(III) and V(V) follows a two step process. The first step involves the formation of a binuclear complex, $TiOHVO_2^{4+}$. With the establishment of equilibrium in this first step, the second step occurs which involves the redox step. The mechanism proposed for these two steps is:

$$Ti^{3+} + H_2O \overset{K_{a_1}}{\rightleftharpoons} TiOH^{2+} + H^+$$

$$TiOH^{2+} + VO_2{}^+ \underset{k_r}{\overset{k_f'}{\rightleftharpoons}} TiOHVO_2^{4+}$$

$$TiOHVO_2^{4+} \overset{K_{a_2}}{\rightleftharpoons} TiOVO_2^{+} + H^+$$

$$TiOVO_2^{4+} \xrightarrow{k} Ti(IV) + V(IV)$$

The first two equations represent the first step and yield the following rate law: $-d[Ti(III)]/dt = \{k_r + k_f'K_{a_1}[Ti(III)](K_{a_1} + [H^+])^{-1}\}[V(V)]$ the remaining equations represent a possible interpretation of the second step and yield the following rate law: $-d[Ti(III)]/dt = kK_{a_1}K_{a_2}k_f'k_r^{-1}(K_{a_1}[H^+] + [H^+]^2)^{-1}[Ti(III)](1 + K[Ti(III)])^{-1}[V(V)]$ with $K = k_f'K_{a_1}k_r^{-1}(K_{a_1} + [H^+])^{-1}$. The reaction between Ti(III) and U(VI) follows a one step process; however, this redox step is inhibited by the presence of V(IV). A mechanism proposed which will explain this inhibition is:

$$Ti^{3+} + H_2O \overset{K_{a_1}}{\rightleftharpoons} TiOH^{2+} + H^+$$

$$TiOH^{2+} + UO_2^{2+} \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} TiO^{2+} + UO_2^+ + H^+$$

$$TiOH^{2+} + UO^{2+} + nH^+ \xrightarrow{k_2} \xrightarrow{[(3-n)H^+,\, fast]} TiO^{2+} + U^{4+} + 2H_2O$$

$$VO^{2+} + nH^+ \xrightarrow{k_3} \xrightarrow{[(2-n)H^+,\, fast]} V^{3+} + UO_2^{2+} + H_2O$$

This mechanism can be used to explain the observed kinetics in the absence of $VO^{2+}$ by omitting the last equation from this steady state rate law. The kinetics data was obtained from a Durrum−Gibson stopped-flow spectrophotometer. (Diss. Abstr. Int. B)

**207** ENZYMATIC SYNTHESIS OF NITROGEN-13-LABELED AMINO ACIDS. Straatmann, M. G.; Welch, M. J. (Washington Univ., St. Louis). Radiat. Res.; 56: No. 1, 48-56(Oct 1973).

Nitrogen-13 is the longest lived radioisotope of nitrogen, and compounds labeled with this isotope can be detected in vivo. In this study $13_N$ labeled amino acids are prepared by enzymatic reactions. The acids prepared are glutamine, glutamic acid, valine, alanine and leucine. In all cases the $13_N$ labeled substrate is ammonia, which must be prepared with a high specific activity for the enzyme reactions to proceed with high yield. The methods available for preparing $13_N$ ammonia were adapted to prepare a high specific activity product. (auth)

**208** DISTRIBUTION OF TRITIUM IN D-GLUCOSE AND STARCH LABELED BY TRITIUM-ATOM BOMBARDMENT. Liang, T. C.; Nordin, P.; Moser, H. C. (Kansas State Univ., Manhattan). Carbohyd. Res.; No. 27, 437-446(1973). (COO-584-50).

Samples of D-glucose and starch were labeled by tritium-atom bombardment. Up to 51% incorporation into D-glucose as nonlabile tritium was achieved for crystalline, anhydrous D-glucose and 41% for the amylose−butyl alcohol complex. Distribution of tritium in the carbon skeleton of D-glucose was calculated by comparing the specific molar activity of D-glucose with that of its derivatives. Derivatives prepared were D-gluconic acid, D-arabino-hexulose phenylosotriazole, 4-formyl-2-phenyltriazole, 2-phenyltriazole-4-carboxylic acid, D-arabino-hexulose phenylflavazole, 3-formyl-1-phenylflavazole, and formaldehyde dimedone. The tritium distribtuion showed definite structural effects. Generally, the products from films of D-glucose and the amylose−butyl alcohol complex had nearly uniform distribution of tritium in D-glucose. The product from crystalline $\alpha$-D-glucose monohydrate had zero tritium at C-2 and twice the expected amount of tritium at C-5, and that from starch granules had zero or near zero tritium at C-3 and close to twice the expected amount of tritium at C-2. (auth)

**209** TRITIUM LABELING OF POLYRIBONUCLEOTIDES. Lauschke, U. Frankfurt am Main; Univ. Frankfurt am Main (1972). 102p. (In German).

Thesis.

Polyribonucleotides were labeled with tritium during incubation in tritium-contained water by an exchange reaction. A specific activity between 1 and 16 mli/mMol was obtained with pure polyribonucleotides: with increasing reaction time the polynucleotides decompose, the bases remain chemically unchanged. The chain shortening of the pure polyribonucleotide cannot be traced back to the $\beta$-radiation of tritium. Iodized cytidine diphosphate was chiefly labelled in position 5 with a specific activity of 30 mli/mMol. In the enzymatic polymerization of 3-H-CDP to 3-H-poly(I), an isotope effect occurs that lowers the specific activity of the polymer by up to 20%. (GE)

**210** HETEROPOLY TUNGSTATES OF Th(IV). Botar, A. V. (Inst. of Chemistry, Cluj); Weakley, T. J. R. Rev. Roum. Chim.; 18: No. 7, 1155-1157(Jul 1973). (In German).

The sodium salt of the $ThW_{10}O_{36}^{8-}$ anion was isolated and the previous formulation as $ThW_5O_{18}^{8-}$ was revised. The investigated heteropoly anion is stable in the range of pH from 5.5 to 8.0. Solutions of the free acid degrade with time. The $Th^{4+}$ ion reacts rapidly with the unsaturated heteropoly anions and yields complexes of the type $ThL_2$, whereby L = $SiW_{11}O_{39}^{8-}$, $PW_{11}O_{39}^{7-}$, and $P_2W_{17}O_{61}^{10-}$. The potassium salt of the type $ThL_2$ was isolated and studied. (tr-auth)

**211** INTERACTION OF Th(IV) AND U(VI) WITH DIPHENYL SULFOXIDE AND DIBENZYL SULFOXIDE. Gadia, M. K.; Rai, R. S. (Birla Inst. of Tech. and Science, Pilani, India). Indian J. Chem.; 11: No. 4, 392-393(Apr 1973).

Infrared spectra of the systems $Th(NO_3)_4$−diphenyl sulfoxide (DPSO) and $Th(NO_3)_2$−dibenzyl sulfoxide (DBSO) reveal the formation of complexes having the stoichiometries 4 : 1 (metal : ligand) at 1285 $cm^{-1}$ and 2.4 : 1 at 960 $cm^{-1}$. This is further supported by conductivity measurements of the systems in acetonitrile. A very strong molecular complex (1 : 3, metal : ligand) is formed at 1260 $cm^{-1}$ by uranyl nitrate with DPSO or DBSO. (auth)

**212** COMPLEXES OF DITERTIARY PHOSPHINE AND ARSINE OXIDES WITH METAL IONS: PART VI. Complexes of Uranyl Halides with Oxides of 1,2-Ethylene-Bisdiphenyl Phosphine/Arsine and 1,4-Butylene-Bisdiphenyl-Phosphine/Arsine. Sandhu, S. S., Sandhu, S. S. (Punjab Univ., Tatiala, India). Indian J. Chem.; 11: No. 4, 369-370(Apr 1973).

Complexes of uranyl chloride, bromide, and iodide with oxides of 1,2-ethylenebisdiphenylphosphine/arsine and 1,4-butylene-bisdiphenyl-phosphine/arsine of general formula $UO_2X_2L$ (where X is Cl, Br, or I and L is a molecule of the ligand) were prepared. The complexes of chloride and bromide behave as nonelectrolytes while those of iodide are slightly conducting in nitrobenzene. The ir spectral data reveal chelate covalent structures involving polymerization through halogen bridges in order to attain coordination number higher than six. (auth)

**213** FUSIBILITY DIAGRAMS OF SYSTEMS BASED ON THE CHLORIDES OF CALCIUM, LEAD, AND URANIUM. Tsesyatnik, V. N.; Mel'nikov, Yu. T.; Nichkov, I. F.; Raspopin, S. P.; Sushko, V. I.; Trifonov, I. I. Tr. Ural. Politekh. Inst.; 193: 28-31(1971). (In Russian).

Results are reported of a study of the phase diagram of the $PbCl_2-UCl_4$ system and the fusibility diagram of the $CaCl_2-PbCl_2-UCl_4$ system by differential-thermal, chemical, and x-ray phase analyses. In the binary system $PbCl_2-UCl_4$ the compound $4PbCl_2 \cdot UCl_4$, incongruently fusing at a temperature of 385°C, was formed. The eutectic of the $PbCl_2-UCl_4$ system contains 36 mole % $UCl_4$ and is crystallized at 345°C. The transition point of the $CaCl_2-PbCl_2-UCl_4$ system has the composition $CaCl_2$-8 mole %, $PbCl_2$-66 mole %, and $UCl_4$-26 mole % and is fused at 385°C. The eutectic of the $CaCl_2-PbCl_2-UCl_4$ system is crystallized at 320°C and contains 5 mole % of $CaCl_2$, 58 mole % of $PbCl_2$, and 37 mole % of $UCl_4$. (tr-auth)

**214** WATER VAPOR ADSORPTION ON PLUTONIUM DIOXIDE. Stakebake, J. L.; Steward, L. M. (Dow Chemical Co., Golden, CO). J. Colloid Interface Sci.; 42: No. 2, 328-333(Feb 1973).

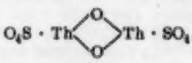
Adsorption isotherms of water vapor on plutonium dioxide were measured gravimetrically at 30, 50, and 85°C. The data show water to be irreversibly chemisorbed until the oxide is saturated. Any subsequent adsorption is physical and completely reversible. The chemisorbed limit varied from 1 monolayer at 85°C to 3 monolayers at 30°C. Gravimetric desorption showed water to be chemisorbed as two different species. A three-step model for the total adsorption process is proposed consisting of: surface hydroxylation (chemisorption); hydrogen bonding of water molecules to surface hydroxyls (quasei-chemisorption); and physisorption of water molecules. (auth)

**215** PAPER CHROMATOGRAPHY OF $^{113m}$In-LABELLED RADIOPHARMACEUTICALS: [$^{113m}$In]DTPA. Jaiswal, D. K.; Chander, J.; Malik, A.; Singh, B. (Inst. of Nuclear Medicine and Allied Sciences, Delhi). J. Chromatogr.; 84: No. 2, 417-418 (26 Sep 1973).

The paper chromatography of $^{113m}$In-labeled radiopharmaceuticals for brain, placenta, liver, and spleen scanning is described. The $R_F$ values of various $^{113m}$In-labeled preparations in various solvents are tabulated. (auth)

**216** THORIUM OXIDE SULFATE ($ThOSO_4$), A NEW SULFATE OF THORIUM. Raman, V.; Jere, G. V. (Indian Inst. of Tech., New Delhi). Indian J. Chem.; 11: No. 5, 476-477(May 1973).

A new sulfate of thorium, $ThOSO_4$, was obtained from thorium peroxo sulfate ($Th \cdot O_2 \cdot SO_4 \cdot 3H_2O$) by thermal decomposition around 500°C. The compound is stable till 650°C and is well-defined crystalline in nature. The sulfate group is bidentate chelating. No evidence is found to suggest the presence of thoryl ion ($ThO^{2+}$). Instead, the compound possesses a dioxo bridged structure



. (auth)

(A)

**217** PRODUCTION OF CARRIER-FREE $H^{11}CN$ FOR MEDICAL USE AND RADIOPHARMACEUTICAL SYNTHESES. IX. Christman, D. R.; Finn, R. D.; Karlstrom, K. I.; Wolf, A. P. (Brookhaven National Lab., Upton, NY). J. Nucl. Med.; 14: No. 11, 864-866(Nov 1973).

A system for the routine production of carrier-free, high-activity $H^{11}CN$ in an on-line process in the effluent stream from a cyclotron gas target is described. The method is highly reproducible and trouble free, and the yields from a given target and synthesis system are entirely predictable. The material is available in the gas phase or in basic solution within 10 to 12 min after the end of the irradiation. With a current of 30 μA of focused 25-MeV protons impinging on the target, 2 Ci of carrier-free $H^{11}CN$ are produced with the present system in a 45-min irradiation. The material has been used in the preparation of carrier-free $^{11}C$-dopamine and $^{11}C$-nonrepinephrine for animal studies, and some investigation has been made of its possible use for blood labeling. (auth)

**218** SIMPLE ELECTROLYTIC PREPARATION OF A $^{99m}$Tc(Sn)-CITRATE RENAL SCANNING AGENT. Schneider, P. B. (Beth Israel Hospital and Harvard Medical School, Boston). J. Nucl. Med.; 14: No. 11, 843-845(Nov 1973).

A $^{99m}$Tc(Sn)-citrate renal scanning agent can be prepared using the electrolytic release of $Sn^{2+}$ from the electrodes to serve as the reducing agent for $^{99m}TcO_4^-$. The materials needed for this method are commercially available in sterile and pyrogen-free form leading to a simple economical preparation. (auth)

**219** CHROMATOGRAPHIC QUALITY OF $^{99m}$Tc LABELED COMPOUNDS. Billinghurst, M. W. (Winnipeg General Hospital, Manitoba). J. Nucl. Med.; 14: No. 11, 793-797(Nov 1973).

The increasingly general use of a number of $^{99m}$Tc-labeled compounds makes the need for an understanding of the capabilities of simple quality-control procedures urgent. A number of $^{99m}$Tc radiopharmaceuticals that are already in general use were studied in various chromatographic procedures that might potentially provide adequate quality control. The comparative effectiveness of each of these chromatographic procedures for the accurate quality control of each radiopharmaceutical may be readily observed and an adequate procedure decided on. The practical ease of handling and the technical skills necessary for the accurate handling of each chromatographic system is discussed. It is recommended that quality control of $^{99m}$Tc-albumin be done on a Sephadex G50 column and that of $^{99m}$Tc-DTPA be done with thin-layer silica gel chromatography in both saline and acetone or butyl acetate. The quality-control procedure for $^{99m}$Tc-polyphosphate is shown to be dependent on the commercial kit which is used. Two such commercial kits are discussed. (auth)

**220** COMPREHENSIVE INORGANIC CHEMISTRY. Volume 5. Trotman-Dickenson, A. F. (ed.). Oxford; Pergamon Press Ltd. (1973). 728p.

The occurrence, separation, preparation, crystal structure, and chemical and physical properties of the actinides are discussed. The analytical chemistry of the more readily available actinides, Th, Ac, Pu, U, Pa, Np, and Am is considered in detail. A great deal of information on the alloys, compounds, and complexes of the elements as well as the solution chemistry of the actinide ions is included. (811 references) (JGB)

**221** DIFFUSION OF PLUTONIUM NITRATE IN POLY (VINYL-CHLORIDE) PLASTIC COMPOUND 57-40. Kononovich, A. L.; Klochkov, V. N.; Gol'dshtein, D. S. At. Energ. (USSR); 35: No. 2, 117-119(Aug 1973). (In Russian).

The diffusion of $^{239}$Pu from solutions of its nitrate salt in poly-(vinyl-chloride) plastic compound 57-40 was investigated. It was shown that the formation of absorbed phase during sorption from water solution takes place only in the presence of a "salt out" substance. It was established that the process of $^{239}$Pu transfer does not follow Fick's law. Nevertheless, diffusion can be described in the form of an approximate Fick model with a correction. The corresponding phenomenological constants are presented. (auth)

## *Radioactive Waste Treatment*

*Refer also to abstracts 118 and 149.*

**222** (ICP-1026) REMOVAL OF CHLORIDE FROM SECOND-CYCLE WASTES AT THE IDAHO CHEMICAL PROCESSING PLANT. Newby, B. J. (Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs - Operations Office). Aug 1973. Contract AT(10-1)-1375. 34p. Dep. NTIS $4.00.

Laboratory experiments were conducted to investigate methods for reducing the concentration of chloride in second-cycle waste stored at the Idaho Chemical Processing Plant. Eight methods were investigated for possible plant installation prior to calcination, including oxidation to chlorine (oxidation with ozone, potassium permanganate, and hydrogen peroxide and electrolytic oxidation); chloride removal by nitric acid boildown; chloride removal with nitric oxide; and chloride removal by precipitation (mercurous nitrate, metallic mercury, and silver nitrate). (auth)

**223** (RDT-M-16-1-T(10-73)) GAS-PHASE ADSORBENTS FOR TRAPPING RADIOACTIVE IODINE AND IODINE COM-

POUNDS. (USAEC Division of Reactor Research and Development, Washington, D. C.). Oct 1973. 25p. RSO.

This standard covers granular adsorbents (activated carbon, mineral base, polymer, etc.) for use in air and gas treatment systems. The absorbents are used in both thin-bed absorber cells and deep-bed systems. The standard includes document list, technical requirements, quality assurance requirements, and preparation for delivery. Test and sampling procedures are given. (DLC)

**224** PROCESS AND DEVICE FOR THE DECONTAMINATION OF RADIOACTIVE EFFLUENTS. Schmal, W. (to Metall Gesellschaft AG). German Patent 1,642,487. 6 May 1971. Filed date 9 Feb 1967. (In German).

A process is described for the decontamination of liquids containing gas and contaminated by radioactivity, in particular waste water, where the liquid is decomposed by degassing, evaporation, and condensation into radioactive concentrates, one part gaseous, possibly radioactive, and one decontaminated liquid. The liquid is evaporated, condensed, and the condensate is degassed. (EJH)

**225** GENERAL METHOD OF SYNTHESIS OF NITROSYL COMPLEXES OF TRANSITION METALS. Bandyopadhyay, P.; Rakshit, S. (Univ. of Calcutta). Indian J. Chem.; 11: No. 5, 496(May 1973).

A novel method for the introduction of nitric oxide group to transition metals, viz. Re(IV), Mo(IV), Pd(IV), Mn(IV), U(IV), and Co(III), is described. The method involves the passage of gaseous nitric oxide through a hot suspension of hydrated metallic oxides in aqueous hydrochloric acid. (auth)

**226** TESTING OF NEW SORBENTS FOR DECONTAMINATING LOW-LEVEL RADIOACTIVE LIQUID WASTES. Rauzen, F. V.; Trushkov, N. P. At. Energ. (USSR); 35: No. 2, 105-108 (Aug 1973). (In Russian).

Results obtained in decontaminating low-level radioactive, liquid wastes by means of partly sulfonated bitumen and carboxylic organic cationite KB-51 are reported. It was established that the capacity of partly sulfonated bitumen amounts to 0.9 to 1.2 mg-equiv/1 and that it is not better than cationite KY-2 in the Na form. It is shown that for decontaminating salt solutions it is expedient to use cesium-selective KB-51 together with KY-2 and Ab-17 ionites in salt forms. (auth)

## *Radioisotope Production*

**227** (MLM-2068, pp 48-51) SEPARATION CHEMISTRY. (Mound Lab., Miamisburg, Ohio (USA)). 22 Aug 1973.

In Mound Laboratory activities for the Division of Physical Research: January–June 1973.

**228** DEVELOPMENT TOWARDS THE PRODUCTION ON A ROUTINE SCALE OF IODINE-131. Valdes, F. L. E. Mexico City; Universidad Nacional Autonoma de Mexico (1973). 76p. (In Spanish).

Thesis.

In view of the fact that there is statistically no difference between the methods, the criteria for selecting one of them were based on the observations made in accomplishing them. It is necessary to remember that the quantity of $^{131}$I that it is desired to be produced is about 1.5 Ci/week, which implies an increase in the time of irradiation, the neutron flux, and the quantity of starting material. The increase in the amount of starting material causes the volumes in solution, distillation and radioactive wastes to be greater for the wet methods than for the dry method. In the dry method the operation is simpler since it suffices to introduce irradiated tellurium into the equipment and heat it; on the other hand, in the wet methods it is necessary to decant. On the basis of this, the method selected was the dry one, and later on the experimental equipment was proposed that will serve for the experiment up to the optimum temperature for distillation. In proposing the experimental equipment, certain factors were considered in reference to the system in which the work would be carried out. It could be considered that the $^{131}$I would remain trapped in the crystalline matrix of the tellurium (0.019488 × $10^{-5}$ g $^{131}$I/g Te, at 2 Ci $^{131}$I and 80 g Te), and on increasing the temperature, the atoms of Te that are found forming the crystalline network will acquire vibrational energy, by which the bonds are weakened allowing the $^{131}$I to emanate from the tellurium stratum. The emanation of $^{131}$I is initiated starting at 330°C and becomes difficult at temperatures near the melting point of Te (450°C). From this it is seen that the temperature range for experimentation will be from 330 to 430°C, and once the optimum temperature of operation has been determined in this range, the $^{131}$I can be produced in a routine manner. (tr-auth)

**229** PREPARATION OF CARRIER-FREE $^{131}$Cs FROM CYCLOTRON-IRRADIATED CESIUM FLUORIDE. Buksak, D.; Chow, A. (Univ. of Manitoba, Winnipeg). J. Radioanal. Chem.; 14: No. 1, 197-199(Mar 1973).

A procedure is described for the preparation of carrier-free $^{131}$Cs that avoids the lengthy decay period prior to the use of barium as a source of $^{131}$Cs with the consequent loss of cesium activity. The method involves the proton irradiation of cesium with the overall reaction $^{133}\mathrm{Cs(p,n)}\ ^{131}\mathrm{Ba} \xrightarrow{\mathrm{E.C.}} {}^{131}\mathrm{Cs} \xrightarrow{\mathrm{E.C.}} {}^{131}\mathrm{Xe}$. (DHM)

**230** PREPARATION OF THORIUM-FREE URANIUM FOR CONTINUOUS STUDY. Buksak, D.; Chow, A. (Univ. of Manitoba, Winnipeg). J. Radioanal. Chem.; 14: No. 1, 193-196(Mar 1973).

A separation procedure is described for the continuous, carrier-free removal of the daughter product $^{231}$Th(T = 25.6 h) from a sample of $^{235}$U held on a specially designed, flat anion exchange column. Thorium-free uranium prepared by this ion exchange method showed no activity in the 0 to 300 keV region other than $^{235}$U and the $^{235}$U can be maintained free of $^{231}$Th for several weeks by continuous elution at the rate of 4 drops a minute. (DHM)

## *Reactor Fuel Reprocessing*

*Refer also to abstracts 37 and 100.*

**231** (HW-81030) PLUTONIUM DISSOLUTION PROGRAM. Weed, R. D. (General Electric Co., Richland, Wash. (USA). Hanford Atomic Products Operation). 27 Feb 1964. Contract AT(45-1)-1350. 6p. Dep. NTIS $3.00.

The program for the dissolution tests for $PuO_2$ is outlined. (DHM)

**232** (NBL-267, pp 75-79) DISSOLUTION OF PYROCARBON- AND SILICON CARBIDE-COATED URANIUM–THORIUM CARBIDE FUEL BEADS: CHLORINATION AND FUSION DISSOLUTIONS. Hedrick, C. E. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

Studies on the dissolution of pyrocarbon- and silicon carbide-coated uranium–thorium carbide nuclear fuel beads by fusion techniques were continued. Also studied was a high-temperature chlorination technique. A proposed chlorination procedure is described. (auth)

**233** LOW-PRESSURE DISTILLATION OF MOLTEN MIXTURES OF LITHIUM FLUORIDE, BERYLLIUM FLUORIDE, AND ZIRCONIUM FLUORIDE FOR REMOVAL OF RARE EARTH FISSION PRODUCTS. Hightower, J. R. Jr.; McNeese, L. E. (Oak Ridge National Lab., TN). Ind. Eng. Chem., Process Design Develop.; 12: No. 3, 232-236(Jul 1973).

Low-pressure distillation of molten-salt nuclear reactor fuels was demonstrated by processing, at 1000°C, six 38-l. batches of nonradioactive mixtures of LiF, $BeF_2$, $ZrF_4$, and $NdF_3$, and one 12-l. batch of irradiated fuel carrier salt from the molten salt reactor experiment. A distillation rate of 1.5 $ft^3$ of salt per day per square foot of vaporization surface was achieved. Evidences of concentration polarization and/or entrainment were noted. Automatic operation was easily maintained in each run. Condensation of volatile salt components in the vacuum lines and metal deposition in the feed line to the still pot are problems needing further attention. Results of the nonradioactive tests indicate that the application of distillation to molten-salt breeder reactor fuel salt processing is feasible. (auth)

# ENGINEERING

## Energy Conversion

*Refer also to abstract 1353.*

**234** (IPP-IV-53) DESIGN STUDY OF SUPERCONDUCTING 5 TESLA DIPOLE MAGNETS FOR MGD GENERATORS. Eisel, W.; Muntenbruch, H. (Max-Planck-Institut fuer Plasmaphysik, Garching/Munich (F. R. Germany)). Dec 1972. 99p. (In German). Dep. NTIS (U. S. Sales Only) $7.00.

A general design concept for a 5 tesla dipole magnet to be used in a 10 MW MHD generator was developed. The solution allows the linear dimensions of the magnet to be increased or decreased by a factor of about 2 without need of major modifications. The required dimensions and properties of the magnet are: rated field strength—$B_0 = 5$ tesla; magnetic length—$L = 2$ m; uniformity—in a volume 50 cm in dia. and about 2 m in length deviations from $B_0$ should be less than 5%; room temperature bore—circular with a dia. of 70 cm or square with sides 60 cm long. The investigations provided the basic calculations and drawings for designing the magnet system, power supply system, cryogenic system and the control and safety facilities. Various conductors, coil geometries, winding concepts, and design principles were compared. The forces in the coils as well as in the structure were calculated and estimates concerning the quench behavior were made. (auth)

**235** (SLA-73-643) ANALYSIS OF SILICON-GERMANIUM ALLOYS USED IN THERMOELECTRIC APPLICATIONS. Russell, J. C. (Sandia Labs., Albuquerque, N. Mex. (USA)). Oct 1973. Contract AT(29-1)-789. 27p. Dep. NTIS $3.50.

Analytical procedures used in support of a thermoelectric alloy development program are described. Methods used to evaluate raw materials, assess process parameters, and to characterize the alloy are summarized. Emphasis is placed on advantages and disadvantages of the methods for a given determination, particularly with respect to the time required for an analysis, cost in man-hours, and the quality of the result in terms of accuracy and precision. Specific data are included to provide some indication of the efficacy of the methods. 6 tables, 7 figures, 14 references. (auth)

**236** NADEZHNOST' ZHIDKOMETALLICHESKIKH INDUKTSIONNYKH MGD MASHIN. (Reliability of Liquid-Metal Induction MHD Machines). Abkhazi, V. V.; Malykhin, A. I.; Rybin, I. V. Moscow; Energiya (1972). 104p.

General information on the operation of liquid-metal induction MHD-generators and electromagnetic pumps is presented. A nuclear reactor serves as the source of heat for the circulating liquid metal. Pump characteristics are listed. Mathematical predictions and estimates of reliability of MHD-generators and pumps are discussed. Because of their complexity and size, a large number of MHD-machines cannot be tested. From test data on the behavior of materials under various conditions and pump characteristics it is possible to forecast the reliability of operation for various designs of liquid-metal MHD-generators. Shutdowns can occur as a result of: pump failure; cavitation or fatigue to the MHD-channel; cooling condenser failure; and inability to activate the MHD-system. Distribution functions for these shutdowns are presented. Sudden failures as well as gradual failures are taken into account. Data on the reliability of various components in the system are given. The reliability is estimated for various parametric variations within the MHD-system. (SJR)

**237** MAGNITOGIDRO-DINAMICHESKII METOD POLUCHENIYA ELEKTROENERGII. Sbornik Statei. Vypusk Tretii. (Magnetohydrodynamic Method of Producing Electric Power. Collection of Articles. Number 3). Kirillin, V. A.; Sheiindlin, A. E. (eds.). Moscow; Energiya (1972). 359p.

The first section deals with the theory and calculation of MHD-flows including edge effects in channels with metallic walls at the inlet and non-stationary flow in a MHD-channel. Integral methods are used to calculate heat transfer in a MHD-channel. Insulation properties, arc behavior, electrode erosion, suitability of silicon carbide as an electrode material, and electrode configuration are presented in the second part. Plasma diagnostics are covered in Part 3. Studies of nonstationary plasma at high magnetic Reynolds number are emphasized. The behavior of additives ($K_2CO_3$), which ionize at 2500 to 3000°K, is covered in Part 4. Trapping systems for removing these solids were investigated. Section 6 considers problems associated with liquid-metal MHD-generators. Jet systems are covered. Part 6 covers the thermodynamic analysis of plasma and liquid-metal MHD-cycles. Part 7 deals with the materials of construction for the generator. Refractory oxides such as magnesium oxide and stabilized zirconium oxide are used for the walls and electrodes. (SJR)

**238** ENGINEERING ASPECTS OF MHD GENERATION. Rao, B. C. (Osmania Univ., Hyderabad, India). Indian J. Power River Valley Develop.; 23: No. 4, 117-120(Apr 1973).

The principle of magnetohydrodynamics (MHD) and the application of this principle to the generation of electrical energy are explained. MHD generators are compared with conventional generators and the advantages of the former over the latter are pointed out. The technical and economic aspects of different types of MHD generators are discussed. The open cycle and closed cycle systems are also discussed in detail. The need to develop MHD technology to meet the future demands of power in India is stressed. (INIS)

**239** TEPLOOBMEN V VYSOKTEMPERATURNOM POTOKE GAZA. (Heat Transfer in High Temperature Gas Flow). Zhukauskas, A. (ed.). Vil'nyus, USSR; Izdatel'stvo Mintis (1972). 231p.

Fifteen chapters are included. A separate abstract was prepared for each of 9. Six chapters were not in scope for NSA. (LCL)

*For abstracts of individual chapters see: 240—245, 278, 286, and 1813.*

**240** EXPERIMENTAL METHODS OF INVESTIGATING LOW TEMPERATURE PLASMA FLOW. Aksenov, V. V.; Eroshenko, V. I.; Motulevich, V. P.; Mushinskii, A. A.; Chekalin, E. K. pp 7-20 of Teploobmen v Vysokotemperaturnom Potoke Gaza. Zhukauskas, A. (ed.). Vil'nyus, USSR; Izdatel'stvo Mintis (1972). (In Russian).

From the scattering of laser radiation on electrons (scattering cross-section on the order of $10^{-25}$ cm$^2$) it is possible to obtain information on the electron concentration $n_e$ from $10^{12}$ to $10^{19}$ cm$^{-3}$, and plasma temperatures $T_e$ from 1 to 100 ev. Measurements can be carried out on a few ml of plasma volume with a time resolution of $10^{-3}$ to $10^{-8}$ s. Scattering on free electrons occurs in plasmas having a low electron concentration and high temperature. Doppler widening of the scattered radiation gives the distribution of electron velocities. The scattering spectrum is more complex in plasmas dominated by collective processes (dense plasma with relatively low temperatures), but the electron concentration can still be determined. Experiments with a laser on an argon plasma with an electron concentration $n_e \cong 10^{16}$ cm$^{-3}$ and a temperature $T \sim 10^{4}$°K are described, and it is shown that agreement is satisfactory with electron concentrations determined under the same conditions from spectroscopic measurements of Stark line widening. In a magnetohydrodynamic (MHD) generator the electron concentration is related to the saturated ion current in the laminar layer near the electrode surface. Thus, wall probes can be used to measure electron concentrations in supersonic air and argon current flows in shock tubes. Conductivity values were determined from the slope of the volt-amp characteristics for two cases of current flow. Although the determination of electron concentration from the ion saturation current of the volt-ampere characteristics of wall electrodes is reliable, the method requires further careful study. (SJR)

**241** PROBLEMS OF HEAT- AND MASS-TRANSFER IN THE CHANNEL OF A MHD GENERATOR. Motulevich, V. P. pp 66-84 of Teploobmen Vysokotemperaturnom Potoke Gaza. Zhukauskas, A. (ed.). Vil'nyus, USSR; Izdatel'stvo Mintis (1972). (In Russian).

On large power units the amount of heat passing through the channel walls may be ~10% of the total enthalpy flow or ~40% of the electric power. The following parameters are characteristic for a channel of a MHD-generator: temperature $T_0 \sim 3000$°K, pressure $p_{max} \sim 0.3$, $M \sim 1$, gas velocity ~ 1000 m/s, temp. factor ~0.3, channel length ~10, transverse size ~1 m, Reynolds No. $\sim 10^6$, $j \sim 1$ a/cm$^2$. Under these conditions it is shown that gas dissociation plays a substantial role. Surface irregularities with a thickness less or greater than the boundary layer have a great effect on heat transfer. Calculated values of the heat transfer coefficient are obtained from dimensionless relations involving the Nusselt, Prandtl, and Reynold numbers. The agreement with experiment is satisfactory. More data are needed on: turbulent boundary layers in the presence of chemical reactions; mechanism of mineral deposition on electrodes and insulators; turbulent boundary layers under conditions of intense gas cooling of the walls by porous diffusion to protect the walls from erosion; and the effect of surface roughness. In the presence of magnetic and electric fields it is necessary to study: integral characteristics of the turbulent layer making it possible to determine the laws of heat- and mass-transfer; the pulsation distribution; the effect of conductivity on generators having cooled surfaces, and the effect of arcing on the average and local heat- and mass-transfer. (SJR)

**242** SOME RESULTS FROM TESTS ON A MODULE CHANNEL OF MHD UNIT ENIN-2. Zhimerin, D. G.; Bashilov, V. A.; Makarov, Yu. V.; Motulevich, V. P. pp 84-96 of Teploobmen Vysokotemperaturnom Potoke Gaza. Zhukauskas, A. (ed.). Vil'nyus, USSR; Izdatel'stvo Mintis (1972). (In Russian).

The MHD unit consisted of a channel (3 m long), widening out along the electrode walls, with a cross-section 200 × 200 and 200 × 500 mm at the inlet and exit, respectively. The channel body was of welded, stainless steel construction with built in collectors for the cooling agent. The brass cooling electrodes (116 pairs) are rectangular 25 × 200 mm in size. The intra-electrode insulation was an aluminum oxide covering 1.5 mm thick. The dimensions and number of modules were selected so that the voltage between two adjacent modules did not exceed 100 volts. The electrode-ground resistance was $\sim 2\ k^{\Omega}$. The average heat flux was $\sim 1 \times 10^{6}$ kcal/m$^2$ · hr. The wall temperature was ~300°C. No cathode erosion could be detected. The electrical characteristics of the channel are substantially determined by a cold boundary layer having a thickness greater than theoretical. In experiments with an external voltage it is shown that under existing conditions the cold electrodes can give currents whose magnitude is determined only by the conductivity of the gas flow, if the voltage on the electrodes exceeds a certain value. It can be concluded that with an increase in magnetic field or scale-size of the MHD channel it is possible to obtain a MHD power with channel cooling that is the same as obtained with hot electrodes and insulators, when the exit parameters are determined by the gas conductivity. (SJR)

**243** HEAT TRANSFER IN THE BOUNDARY LAYER ON A PLANE SURFACE WITH EQUILIBRIUM DISSOCIATION OF A GAS. Petukhov, B. S.; Vilenskii, V. D. (Inst. of High Temperatures, Moscow). pp 108-121 of Teploobmen Vysokotemperaturnom Potoke Gaza. Zhukauskas, A. (ed.). Vil'nyus, USSR; Izdatel'stvo Mintis (1972). (In Russian).

The specifics of heat transfer in the channel of a MHD-generator are determined mainly by the presence of chemical reactions in the gas current and on the surface walls, and by the significant change in the physical properties of the gas as a function of temperature. It is shown that for the combustion products of methane in oxygen, local equilibrium is attained at a boundary layer thickness of fractions of a millimeter at $p \sim 1$ atm. The gas composition at equilibrium is completely determined by the local values of temperature and pressure. Dissociation may lead to a decrease of 30% in Stanton number, and to a decrease of a factor of 5 in Stanton number at a wall temperature $T_w$ = 500°K and a gas temperature $T_\infty$ = 15,000°K. Calculations carried out for air involve a temperature change for the gas over the range from 1000° to 15,000°K, change in wall temperature $T_w$ from 500 to 3000°K, and a change in pressure from 1 to 100 atm. It is found that the heat capacity, viscosity and thermal conductivity as a function of temperature become non-monotonic. Dissociation leads to a 15% decrease in the frictional resistance coefficient. Data on heat transfer, thermal conductivity and frictional resistance are presented in the form of dimensionless ratios. A sharp increase in heat flux is observed at 3600°K as a result of gas dissociation for methane in air enriched with oxygen. This effect is significant and should be taken into account in design calculations. (SJR).

**244** PROBLEMS OF HEAT TRANSFER AND THE DESIGN OF HIGH-TEMPERATURE HEAT EXCHANGERS FOR ELECTRICAL POWER PLANTS HAVING MHD-GENERATORS. Tager, S. A. pp 164-179 of Teploobmen Vysokotemperaturnom Potoke Gaza. Zhukauskas, A. (ed.). Vil'nyus, USSR; Izdatel'stvo Mintis (1972). (In Russian).

A set of equations is given that relates the operating temperatures in a combustion chamber with the gas temperature during high-temperature heating of air and of air enriched with 50% oxygen by weight. The average, actual temperature of the combustion products at the chamber exit is given as a function of the average, effective temperature of the combustion air. A 5% excess of oxidant was found to be optimum. The heat loss to the cooled walls is taken into account in burning dry coal dust at p = 1 atm. with a moisture content of 1%. In the region of a combustion product temperature $T_c < 1600$°C, where gas dissociation shows no noticeable effect, an increase in air inlet temperature of 100°C leads to an increase in $T_c$ of ~60°C. As a result of the negative effect of dissociation, at 1800°C this increase in air heating causes an increase in gas temperature of 50°C; at $T_c$ = 2000°C the increase is 40°C, and at 2200°C the increase is ~30°C. Preheating air enriched with 50% oxygen is very inefficient. An increase in inlet temperature of 100°C leads to an increase in gas temperature at the chamber exit of 12°C over the entire range of inlet temperatures from zero to 2500°C. Preheating air to 1200 to 1500°C and air enriched with 50% oxygen to ~800°C leads to intense burning of the coal dust-air mixture. A heat exchanger employing liquid melt cooling was designed to preheat air from 340 to 700°C at a rate of 220,000 m$^3$ per hr. Temperature characteristics and viscosities of various acid and base melts containing 2 to 65% calcium oxide are presented for use as heat transfer agents. (SJR)

**245** HEATING AIR AND GASES TO 1500°C AND HIGHER IN HIGH TEMPERATURE REGENERATIVE HEAT EXCHANGERS WITH STATIONARY BALL PACKING. Poletavkin, P. G. (Inst. of High Temperatures, Moscow). pp 192-209 of Teploobmen Vysokotemperaturnom Potoke Gaza. Zhukauskas, A. (ed.). Vil'nyus, USSR; Izdatel'stvo Mintis (1972). (In Russian).

Air at a flow rate of 0.5 to 1.5 kg/s and a pressure of 1.2 to 1.5 atm. was heated to 1500°C in a small regenerative, two-chamber air heater used in conjunction with a MHD-generator. The water-cooled distributing valves operated satisfactorily over a period of 3 months and more. The distribution of temperatures in the packing is almost linear, when the ratio of water heat equivalents of heating and cooling agents is close to one. When the ratio of heat loads is substantially greater than one, there is a substantial distortion in temperature profile along the layer height in the regenerative heat exchanger. The lower packing layers are used inefficiently. The temperature of the ball packing was homogeneous at various positions because of the high hydraulic resistance of the packing. Over the whole range of Reynolds number from 200 to 1200 the experimental data can be described by a single equation: Nusselt number = 0.11 Re. The resistance coefficient is given as a function of the Reynolds number: $\zeta = 3.23/\mathrm{Re}^{0.25}$. Aluminum oxide was found to be a suitable high-temperature packing material. Zirconium oxide packing was not satisfactory as a result of volatilization of calcium oxide which was used to stabilize the zirconium oxide. In contact with stainless steel the zirconium oxide packing disintegrated, while no chemical attack could be observed with aluminum oxide up to temperatures of 1800°C. Stainless steel ball packing was satisfactory up to temperatures of 700 to 800°C after more than 500 h of operation. The heating efficiency was rather high at 85 to 90% because of the large heating surface of the packing (equal to 180 m$^2$/m$^3$ at a ball diameter of 20 mm). Natural gas is used as the fuel. The tentative design of a large air-heating unit handling 100 kg/s is shown. (SJR)

**246** INVESTIGATION OF A THERMIONIC CONVERTER FILLED WITH Cs–Ba UNDER OVERNEUTRALIZED KNUDSEN CONDITIONS. Babanin, V. I.; Dunaev, Yu. A.; Mustafaev, A. S.; Sitnov, V. I.; Ender, A. Ya. (Ioffe Inst. of Physics and Tech., Leningrad). Sov. Phys.-Tech. Phys. (Engl. Transl.); 17: No. 8, 1326-1332(Feb 1973).

Translated from Zh. Tekh. Fiz.; 17: No. 8, 1662-1668.

The plasma parameters and cathode properties under overneutralized Knudsen conditions in a thermionic converter were determined. An external transverse magnetic field was used for the diagnostics. The values of the plasma potential, the width of the anode region, and the density of the charged particles were determined for different conditions in the gap. The experimentally measured ion current density was compared with that calculated from the Saha–Langmuir equation. Information on the surface properties of a polycrystalline tungsten cathode (its work function and effective contrast) was obtained for working conditions. (auth)

**247** OSCILLATIONS IN A COLLISIONLESS THERMIONIC CONVERTER. Kuznetsov, V.I.; Ender, A.Y. (A. F. Ioffe Physicotechnical Institute, Academy of Sciences of the USSR, Leningrad). Sov. Phys.-Tech. Phys. 17: No. 11, 1859-1863 (May 1973).

The frequency dependence of the impedance of a thermionic converter with plane geometry is investigated in regimes in which the directed velocity of the electrons is large; frequencies higher than the plasma frequency are studied. It is shown that the excitation of electron oscillations in the plasma depends on the electrode spacing. The frequency also depends on the magnitude of the spacing. Oscillations can be excited at frequencies far below the electron plasma frequency. An experimental study of the oscillations can give basic information on thermionic converters under certain conditions. The paper is a generalization of an earlier work by Piers. (auth)

## Facilities and Equipment

*Refer also to abstracts 325, 326, 939, 961, 1984, 1988, 2019, 2348, 2349, 2351, 2391, 2395–2398, and 2403.*

**248** (CONF-731105-1) PRESSURE VESSEL RELIABILITY AS A FUNCTION OF ALLOWABLE STRESS. Arnold, H. G. (Oak Ridge National Lab., Tenn. (USA)). 1972. 27p. Dep. NTIS $3.50.

From Winter meeting of American Society of Mechanical Engineers; Detroit, Michigan, USA (11 Nov 1973).

The probability of failure corresponding to specified levels of allowable design stress was calculated for pressure vessels designed in accordance with the ASME Boiler and Pressure Vessel Code. The analysis was performed for maximum shear stress failure and for cyclic stress failure. The significance of such failure prediction is discussed and a rationale for selecting an allowable stress is presented. Examples are presented that demonstrate the estimation of vessel failure probability as a function of load variation, strength variation, and design safety factor. (auth)

**249** (LA-5423-MS) CARBON RECEPTOR REACTIONS IN SUBTERRENE PENETRATORS. Stark, W. A. Jr. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1973. Contract W-7405-eng-36. 7p. Dep. NTIS $4.00.

The lifetime of the carbon receptors used in present designs of rock-melting penetrators was examined from the point of view of carbon diffusion into the metal body of the penetrator. Lifetimes of $3.6 \times 10^3$ ks (1000 h) seem possible for both molybdenum and tungsten penetrators, but molybdenum designs tend to be more critical. It is shown that coating the receptor with a thin 0.06-mm-thick layer of TaC could extend receptor lifetime significantly, particularly for molybdenum penetrator bodies. (auth)

**250** (LMEC-TDR–73-7) FAILURE ANALYSIS OF A SODIUM PRESSURE TRANSMITTER IN SCTI. Lee, W. T. (Liquid Metal Engineering Center, Canoga Park, Calif. (USA)). 20 Jun 1973. Contract AT(04-3)-700. 28p. AT.

As a result of a small sodium leak in an SCTI pressure transmitter (PI-309E), all of the installed units (PI-309E) were removed from the SCTI secondary and primary sodium loops for nondestructive (NDT) and metallurgical examinations. Results of the metallurgical and NDT examinations performed on these units are summarized. These examinations showed that the leak in PI-309E resulted from two small cracks in an area adjacent to a weld joining a support gusset to the 1-in.-diameter freeze trap pipe. Based on crack morphology ("beach marks" on the fracture surface) and stress analysis, it is concluded that cracking was the result of a fatigue mechanism related to vibration present at the secondary sodium pump outlet. Dye penetrant inspection and visual examinations (at magnifications to 25×) failed to reveal any cracking in that unit (PI-303E) removed from the SCTI primary loop. (auth)

**251** (LMEC-TDR–73-8) FAILURE OF A BELLOWS VALVE AND VALVE BODY IN A SYSTEM FOR INJECTING $H_2/H_2O$ INTO LIQUID SODIUM. Hoffman, N. J. (Liquid Metal Engineering Center, Canoga Park, Calif. (USA)). 29 Jun 1973. Contract AT(04-3)-700. 28p. AT.

A metallurgical analysis of a failed bellows and valve body in a system for injecting $H_2/H_2O$ into liquid sodium is discussed. Stress corrosion cracking from aqueous NaOH solution is shown to be the mode of failure. Fully annealed stainless steel appeared to be immune from cracking in this instance. It is pointed out that this type of failure is a serious possibility in pure $H_2O$ vapor injection tests into sodium within the hardware that is exposed to a high-water-vapor-to-sodium-vapor ratio environment. Methods of avoiding the problem are discussed. (auth)

**252** (LMEC-TDR–73-9) EVALUATION OF HEATER CIRCUIT PROTECTIVE DEVICES AS A MEANS OF LIMITING HEATER FAILURE DAMAGE. Davis, K. A.; Fischer, B. E.; Schiowitz, H. H. (Liquid Metal Engineering Center, Canoga Park, Calif. (USA)). 27 Aug 1973. Contract AT(04-3)-700. 209p. AT.

A test program conducted at the Liquid Metal Engineering Center (LMEC) to determine the effectiveness of several candidate protective devices in preventing damage upon failure of a tubular electrical resistance heater is described. The tests were designed and conducted in a manner to promote rapid electrical heater failure. After heater failure was induced, electrical arcing was permitted until the circuit protective device under test cleared the electrical circuit. The extent of damage to the electrical heater sheath and to the surrounding components was observed and recorded. A thermal circuit breaker, fast-blow fuses, and a ground fault interrupter system were tested. In addition, the effects of installing a 0.030-in. stainless steel shim between the heater and the heated component were evaluated. (auth)

**253** (TID-3336) STANDARDS IN NUCLEAR SCIENCE AND TECHNOLOGY. A Bibliography. (Technical Information Center (AEC), Oak Ridge, Tenn.). Sep 1973. 239p. Dep. NTIS $7.60.

Abstracts of 1803 U. S. and non-U. S. publications concerning a broad range of standards used in nuclear science and technology are included. The publication dates span the period 1962 through 1972, inclusive. Abstracts are arranged chronologically within four categories entitled Reactors and Engineering, Instruments and Calibration, Radiation and Radiation Protection, and Miscellaneous. A subject index is also included. (auth)

**254** DESIGN AND EXPERIMENTAL INVESTIGATION OF THE LOW-CYCLE RESISTANCE OF VESSELS FRACTURE. Serensen, S. V.; Makhutov, N. A.; Rakhmilevitch, R. Z.; Schneiderovitch, R. M. (Inst. of Mechanical Engineering Research, Moscow). pp 743-751 of Second International Conference on Pressure Vessel Technology. II. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P2.

Stress analyses and experimental data are necessary to determine the load capacity and failure conditions and therefore, the safety of large pressure vessels used in power plants, refineries, and chemical plants. Low-cycle loading of pressure vessels involves a possibility of local plastic deformations in stress concentration zones as well as beyond them, which is promoted by the addition of thermal stresses to those produced by the internal pressure. Elastoplastic strains arising in such cases are of a nonstationary character resulting from the nonstationary operating conditions on one hand and from changes in the material strength due to cyclic plastic deformations on the other one. Therefore, the evaluation of the load capacity of pressure vessels under low-cycle loading conditions should be based on the results of either an analytical or experimental determination of the kinetics of local stresses and strains and on corresponding criteria of low-cycle failures for nonstationary conditions of cyclical elastoplastic deformation. Fundamentals of strength calculations for structural elements under low-cycle loading are reviewed, and basic mathematical relationships for estimating the strength of pressure vessels, involving a comparison of calculated and experimental results, are cited. (LCL)

**255** DESIGN OF VERY HIGH PRESSURE VESSELS FOR REPEATED PRESSURE APPLICATIONS. Tomkins, B. (United Kingdom Atomic Energy Authority, Springfields, Eng.). pp 835-847 of Second International Conference on Pressure Vessel Technology. II. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P2.

The technological application of high pressure involves the design of components which will safely contain the high pressure medium throughout service life. High pressures mean that high material stresses will be present in some areas so there is a possibility of excessive deformation. If the pressure application is repeated, the high stresses can lead to fatigue failure. The deformation and fatigue behavior of simple cylindrical vessels at pressures up to 96 Ton f/in.$^2$ (14.8 kb) are described. These studies indicate the parameters which control fatigue failure in such vessels, on the basis of which the evolution of more complex, fatigue resistant designs is discussed. Finally, test results on several complex vessels are presented which show the extent to which vessel performance is improved and the degree to which this improvement depends on the materials used. (auth)

**256** DEFINITION OF STRESS-INTENSITY FACTORS IN CRACKED PLATES AND SHELLS. Bergez, D. (Societe Nationale des Petroles d'Aquitaine, Pau, France); Radenkovic, D. pp 1089-1093 of Second International Conference on Pressure Vessel Technology. II. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P2.

Two modes of rupture in bent plates and shells are shown; symmetric, corresponding to mode I and antisymmetric corresponding to an interaction of model II and III. Mode III being essentially connected with shearing forces, Kirchhoff's hypothesis cannot be retained. For this reason, a possible formulation of Reissner's theory, introducing the mean relative rotation of the material normal is presented. A local investigation of singularities enabled a full characterization of cracks to be given. The various known solutions in the case of plates, as well as in the case of shells, are discussed. A generalization of Rice's integral is also given. (auth)

**257** FRACTURE ANALYSIS IN AREAS OF HIGH NOMINAL STRAIN. Sumpter, J. D. G.; Turner, C. E. (Imperial Coll. of Science and Tech., London). pp 1095-1103 of Second International

Conference on Pressure Vessel Technology. II. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P2.

The fracture analysis of thick-walled pressure vessels operating outside the conventional limit of linear elastic fracture mechanics is considered. Particular attention is given to small cracks in regions of local plasticity. An elastic-plastic finite element analysis of cracks emanating from a hole in a plate under uniform tension forms the basis for an assessment of the elastic stress intensity factor, crack opening displacement, and J contour integral approaches. Recommendations are presented for the fracture analysis of cracks at plastic strain concentrations. (auth)

**258** FLAT ROLLED AND HOT-FORMED PARTS OF HIGH-STRENGTH STEELS FOR HEAVY PRESSURE VESSELS. Neuhaus, W. (Thyssen Niederrhein AG, Bonn). pp 1195-1207 of Second International Conference on Pressure Vessel Technology. II. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P2.

It is pointed out that pressure vessel size increased steadily during the last 20 years in West Germany. At the same time, the use of high-strength steels permitted reductions in wall thickness. Several examples of such vessels are shown. Steel makers contributed to this development by producing steels with improved homogeneity and by reducing the anisotropy of heavy plates in the through thickness direction. Better structural homogeneity can be achieved in heat-treated steels, if sufficient alloy content is used to allow low-temperature transformation even in the center of heavy plates. In recent years German pressure vessel fabricators have preferred high-strength steels with precipitation hardening elements to quenched and tempered materials, widely used in America. High-strength steels require proper working conditions, thorough inspection during welding, and post weld heat treatment. It is shown that stress-relief annealing may affect the steel properties, if temperature and time are not adequate to the material. Some remarks are made concerning safety factors, cyclic loading, corrosive influences and regulations for fabricating of pressure vessels that have been proved useful in West Germany. (auth)

**259** DETERMINATION OF STRESS CONCENTRATIONS AT NOZZLE-TO CYLINDER INTERSECTIONS AND COMPARISON WITH EXPERIMENTAL ANALYSIS. Spaas, H. A. C. M. (Delft Univ. of Tech., Netherlands). pp 155-165 of Second International Conference on Pressure Vessel Technology. I. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P1.

The determination of the detailed stress distribution (including peak stresses) for nozzle-to-cylinder connections is highly complicated because of the essentially nonaxisymmetric character of geometry and loading. A computational method based on finite element theory is described treating the reinforced nozzle section as geometrically axisymmetric and using Fourier's series expansions for loadings and displacements. Particular attention is paid to the definition of continuity conditions between the main nozzle elements, i.e., circular cylindrical shell with circular cutout and the reinforced nozzle section. Some LWR nozzle configurations have been analyzed (BWR: $d/D \leq 1/4$, PWR: $d/D \leq 1/3$), and the results have been compared with both three-dimensional finite element computations and strain gage measurements on models and full scale vessels. (auth)

**260** AUTOMATED STRESS ANALYSIS. Poort, J. (Rotterdam Dockyard Co.). pp 203-210 of Second International Conference on Pressure Vessel Technology. I. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P1.

A computerized stress analysis system for components subjected to the rules of the ASME Boiler and Pressure Vessel Code, Section III, Nuclear Power Plant Components is presented. This system consists of a number of temperature- and stress calculation programs and a special purpose stress analysis computer code with which stress intensity values and cumulative fatigue usage factors can be determined, using the stress distributions as evaluated by means of the stress calculation programs in the system. Steady- and transient temperature calculation programs based on finite element and finite difference techniques are part of the system. The stress calculation programs are based on the finite element method, thin shell theory, or these are special-purpose computer codes, e.g., for the analysis of the main closure flange of a nuclear reactor vessel or for the evaluation of thermal skin effect stresses. The final stress analysis program performs the actual analysis of stress distributions, based on the applicable stress criteria. The output of this program has been prepared to be a solitary part of the stress report. This program provides all relevant information for both designer and stress analyst in the shape of a printed and plotted output. In case of a fatigue analysis, the stress differences and alternating stress intensities are plotted varying with load cases for each stress cycle and at all points of the structure which are being analyzed. This system is a useful tool for the design engineer, if next to loads due to internal or external pressure a number of complicated thermal loadings may have a large influence on the design. Further the stress analyst can apply the system with benefit if the loading of the component is divided into a large number of different load cases and stress cycles, such as in case of a feed water nozzle of a boiling water reactor vessel. Specially for high loaded components where a conservative approach is not possible and a precise analysis is necessary to keep within the stress limits, this system works accurately and economically. (auth)

**261** ELASTIC–PLASTIC AND CREEP ANALYSIS OF PIPELINES BY FINITE ELEMENTS. Hibbitt, H. D. (MARC Analysis Research Corp., Providence); Sorensen, E. P.; Marcal, P. V. pp 239-251 of Second International Conference on Pressure Vessel Technology. I. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P1.

A finite element method was developed for the analysis of nonlinear pipelines with elastic–plastic and creep behavior. A study was made of a nonlinear pipeline subjected to a cyclic drop in temperature and with hold times in creep. (auth)

**262** OUT-OF-PLANE LIMIT COUPLES OF NOZZLES IN CYLINDRICAL VESSELS OR BRANCH PIPES IN TEE CONNECTIONS. Ellyin, F. (Univ., Sherbrooke, Quebec); Turkkan, N. pp 361-373 of Second International Conference on Pressure Vessel Technology. I. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P1.

A lower bound to an out-of-plane limit couple applied to the nozzle of a nozzle-cylindrical vessel attachment (or branch-pipe tee connection) is determined. Using the limit couple as an objective function, a lower bound is found by maximizing the couple over a statically consistent stress field subject to inequality constraints imposed by the material yield condition. The limit couple thus formulated has been calculated for a wide range of geometric parameters. The results are valid for all diameter ratios, applicable to both nozzles in cylindrical pressure vessels and branch pipes in piping systems. (auth)

**263** COMPARISON BETWEEN EXPERIMENTAL AND COMPUTER ANALYSES OF THE BEHAVIOUR UNDER PRESSURE OF A 90° BEND WITH AN ELLIPTICAL SECTION. Vrillon, B. (CEN de Saclay, Gif-sur-Yvette, France); Roche, R.; Baylac, G. pp 427-436 of Second International Conference on Pressure Vessel Technology. I. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P1.

The development of industrial techniques requires a more and more detailed analysis of the behavior of pressure vessels. The different possible modes of failure must be taken into consideration. Calculation methods are generally based on an elastic analysis and hence it is necessary to understand the final results and to distinguish for example between different types of stresses: primary, secondary, peak, etc. This distinction is particularly difficult in some cases, including that developed here, which concerns a 90° bend of large diameter (about 2 meters) subject to a working pressure of 25 bars and possessing a central section in the form of a cylinder with an elliptical base. The characteristics of the structure led to the carrying out of two simultaneous analyses by experiment and by computer analysis. The comparison of the results obtained was very instructive. The experimental analysis was performed on two mockups equipped with the appropriate instruments: electric strain gages, elongation transducers, etc. Load was applied by increasing pressure. Deformations were measured throughout the test. On these models it was possible to determine the collapse load (in limit analysis); the plastic instability (bursting load); and the incremental collapse (shakedown) and thus obtain a direct indication of safety with respect to these modes of failure. The calculations were executed with the POCO computer system developed by the CEA. This system contains the TRICO program which is able to calculate three dimensional shells in elastic or elastic-plastic regime. (auth)

**264** ANISOTROPIC CREEP. Hillier, M. J. (Memorial Univ. of Newfoundland, St. John's). Nucl. Eng. Des.; 25: No. 3, 438-440(1973).

The creep rates of an anisotropic metal are characterized by a generalized creep stress, a generalized creep strain rate, and a corresponding flow rule. Invariance rules lead to a generalized strain rate function which differs significantly from that previously proposed. The method is applied to a pressurized thin cylinder of material having three orthogonal principal axes of anisotropy. (auth)

**265** NON-LINEAR CREEP BUCKLING WITH RANDOM TEMPERATURE VARIATIONS. Huang, W. N. (Argonne National Lab., IL). Nucl. Eng. Des.; 25: No. 3, 432-437(1973).

The effect of randomness in temperature on non-linear creep buckling—particularly the predictions of time to onset of instability of a column under compressive loads and a long thin cylindrical shell under uniform external pressure is investigated. Using the statistical properties of lognormal random processes, a qualitative estimate of how uncertainties in critical time are related to randomness in temperature is presented. It is found that the critical times are significantly reduced due to variations in temperature. (auth)

**266** IN-PLANE VIBRATION OF CONTINUOUS CURVED BEAMS. Chen, S. S. (Argonne National Lab., IL). Nucl. Eng. Des.; 25: No. 3, 413-431(1973).

An analytical technique is developed for determination of the frequencies of continuous curved beams. A detailed analysis is carried out for periodically supported beams. It is shown that in an infinite periodic beam, alternate passing bands and stopping bands exist, and in a finite periodic beam, all natural frequencies are in the passing bands. Simple formulas are derived for determining the frequencies of periodically supported rings and continuous beams with the two extreme ends hinged-hinged, hinged-fixed, and fixed-fixed. (auth)

## Heat Transfer and Fluid Flow

*Refer also to abstracts 239, 241, 243–245, 429, 503, 1776, 1781, 1813, 1985, 1999, 2072, 2079, 2081, and 2087.*

**267** (CEA-R-4448(1)) RECIRCULATING FLOWS IN A RECTANGULAR CAVITY. I. Isothermal Case. Grand, D.; Latrobe, A.; Vernier, P. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Sep 1973. 85p. (In French). Dep. NTIS (U. S. Sales Only) $6.25.

Fluid motion driven by the shift of a moving wall was examined for rectangular cavities with height/width ratios of 1, 2 and 4. The flow field for a wide range of Reynolds numbers was obtained by using an unconditionally stable numerical method. The results presented mainly show the plotting of streamlines, the velocity profile through the cavity, and the pressure distribution along the walls. The accuracy of the numerical method was reached by trying different mesh sizes and by analyzing the fluid motion close to the walls. The fluid motion mechanism was studied by analyzing the results which were compared, whenever possible, to previously obtained results. (auth)

**268** (CEA-R-4456) TWO-PHASE FLOW DYNAMICS: PROPAGATION OF SMALL DISTURBANCES. Boure, J. (CEA Centre d'Etudes Nucleaires de Grenoble, 38(France)). Oct 1973. 30p. (In French). Dep. NTIS (U. S. Sales Only) $3.50.

The study of the dynamic behavior of two-phase flows is shown to be closely related to that of propagation phenomena. Consequences of this fact based on mathematical models are discussed. The various kinds of models are compared from this point of view, according to the number of conservation equations that they include. Some results from the theory of characteristics are recalled, and the propagation of small disturbances are studied, using a general six conservation equation model. The well-known single-phase flow results appear as limiting cases of the two-phase flow results. In two-phase flows, disturbances give rise to mixed waves which are akin to the dynamic waves of single-phase compressible flows as well as to the kinematic or continuity waves of two-phase incompressible flows. The assumptions made are discussed in the light of the results obtained. It is concluded that the description of the propagation phenomena rests upon the description of the transfers between phases and between each phase and the wall and these transfer laws cannot be expressed as finite functions of the system variables. (auth)

**269** (LA-UR-73-1067) ROCKET-BORNE, LOW GRAVITY CRYOGENIC HEAT TRANSFER EXPERIMENT. Williamson, K. D. Jr.; Edeskuty, F. J.; Taylor, J. F. (Los Alamos Scientific Lab., N. Mex. (USA)). [nd]. Contract W-7405-eng-36. 9p. (CONF-731108-1). Dep. NTIS $3.00.

From AIAA/NSA/ASTM/IES 7th space simulation conference; Los Angeles, California, USA (12 Nov 1973).

In order to obtain steady state data on nucleate boiling heat transfer to liquid helium in a nearly zero gravity environment a rocket-borne experiment was designed, built and successfully flown. A description of the apparatus and flight is presented along with preliminary results. (auth)

**270** APPLICATION OF HOLOGRAPHY TO THE STUDY OF AIR-WATER TWO-PHASE CRITICAL FLOW. Lee, Y. J. Seattle; Univ. of Washington (1973). 170p. University Microfilms Order No. 73-22,586.

Thesis (Ph. D.).

The results of an experimental study dealing with the measurement of drop size and drop velocity for two-phase air-water critical flow are reported. A new photographic technique employing a laser as the light source and using holography to record the results of the photography were important features of this work. The use of a large aperture improved the quality of the photographs to a considerable degree. The ruby laser employed was able to produce double pulses separated by a minimum of 5 μs which allowed for the calculation of the velocity of the drops. The drop size distribution for the system studied both at critical flow and for flows at below the critical value were obtained by using single pulse holograms. It was possible to operate only at quality levels above 0.95. This was also true for the velocity measurements which employed the use of the double pulse laser output. The relative velocities between the two phases allowed for the calculation of slip ratios for the different experimental conditions. The measured slip ratios were between the theoretical predictions advanced by Fauske and Cruver. It was observed that a very considerable portion of the liquid phase was concentrated near the boundary layer as the two-phase mixture emerged from the test section. A separated flow model describing two-phase flow would apparently represent the actual conditions to a better degree than the other models that have been advanced. (Diss. Abstr. Int., B)

**271** INDUCEMENT OF BOILING OF SUPERHEATED LIQUIDS BY GAMMA IRRADIATION. Skripov, V. P.; Sinitsyn, Ye. N.; Danilov, N. N. (Ural Polytechnic Inst., Sverdlovsk, USSR). Heat Transfer - Sov. Res.; 5: No. 5, 61-68(1973).

The average lives are measured of superheated liquids under natural conditions and when irradiated by gamma rays. The results are discussed on the basis of the ionic and thermal initiation models. (auth)

**272** CRITICAL DISCHARGE OF SUPERHEATED AND SUBCOOLED WATER THROUGH CYLINDRICAL PASSAGES AT HIGH PRESSURES. Keller, V. D.; Mal'tsev, B. K.; Khlestkin, D. A. (Heat Engineering Inst., Moscow). Heat Transfer - Sov. Res.; 5: No. 5, 53-56(1973).

The results are presented of an experimental study of the discharge of hot water through cylindrical passages. The pressure range entering the passage was 20 to 221 bars; the subcooling was in the 0 to 90°C range. The test sections had a sharp inlet edge; the diameter of all the passages was 3.5 mm, the ratio of length to diameter ranged from 0.5 to 30. All the measurements were carried out under steady conditions. (auth)

**273** PROGRESS IN HEAT AND MASS TRANSFER. Volume 7. Heat Transfer in Liquid Metals. Conference Held at Trogir, Yugoslavia, September 6–11, 1971. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973). 604p. (CONF-710942-). $54.00.

Forty-one papers on heat transfer in liquid metals are included in this book which is subdivided into 6 subject sections including: eddy diffusivity; liquid-phase channel-flow heat transfer; longitudinal flow through rod bundles; incipient boiling superheat; boiling heat transfer; and miscellaneous topics. A separate abstract was prepared for each paper. (LCL)

*For abstracts of individual papers see: 274–277, 279–285, and 287–316.*

**274** EDDY DIFFUSIVITIES IN LIQUID METALS. Huetz, J. (Centre National de la Recherche Scientifique, Cachan, France). pp 3-23 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

The development of equations for expressing turbulent transport in liquid metals is reviewed by considering past theoretical and experimental studies by numerous researchers, research on the Nusselt number, and the validity of adapting theories of convection for ordinary fluids to turbulent conditions in liquid metals. It is concluded that progress in determining the Nusselt Number, calculating turbulent diffusivities, or predicting temperature profiles in liquid metals has been hampered by assumptions which are almost universally used, and changes in these assumptions are recommended. (LCL)

**275** SODIUM EDDY DIFFUSIVITY OF HEAT MEASUREMENTS IN A CIRCULAR DUCT. Sheriff, N.; O'Kane, D. J. (United Kingdom Atomic Energy Establishment, Risley, Eng.). pp 25-38 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

Measurements were made of the eddy diffusivity of heat in a circular duct with turbulent sodium flow. The conventional method of making such measurements is to take temperature traverses across the fluid stream with a uniform heat flux at the duct wall. For measurements in the central region of the duct this method has several disadvantages, and in the present study a different technique was used. The method used involves the injection of a point source of heat coaxially with the center line of the duct and temperature traverses downstream of the source. From the temperature measurements the total diffusivity is evaluated and hence the eddy contribution can be calculated. The development of the technique is described and values of total diffusivity measured at a Reynolds number of $8 \times 10^4$ are given in detail. A value for the ratio $\epsilon_H/\epsilon_M$ is evaluated. (auth)

**276** MEASUREMENT OF EDDY CONDUCTIVITY IN SODIUM. Fuchs, H.; Faesch, S. (Swiss Federal Inst. for Reactor Research, Wuerenlingen). pp 39-43 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

Temperature profiles in an electrically heated vertical tube were measured in the Pe range 50 to 1000 ($Pr \approx 0.007$). Care was taken to minimize buoyancy effects. The eddy conductivity $\epsilon_H$ was derived by fitting polynomials to the profiles. Preliminary values for $\epsilon_H$ and $\epsilon_H/\epsilon_M$ ($\epsilon_M$ based on the Reichardt expression) are given and compared with earlier measurements. (auth)

**277** RADIAL AND TANGENTIAL TURBULENT DIFFUSIVITIES OF HEAT AND MOMENTUM TRANSFER IN LIQUID METALS. Ramm, H.; Johannsen, K. (Technische Univ., Berlin). pp 45-58 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

An analytical study of eddy diffusivities in both radial and tangential direction for heat and momentum transfer in liquid metals flowing turbulently through smooth plane, circular and concentric annular ducts was carried out. This communication summarizes the main theoretical aspects of the analysis and presents typical results which are compared with the available experimental data and with previous theoretical predictions. (auth)

**278** STRUCTURE OF THE TURBULENT BOUNDARY LAYER IN A HIGH-TEMPERATURE GAS. Zysina-Molozhen, L. M.; Petukhov, L. S.; Shapiro, I. G. pp 53-66 of Teploobmen Vysokotemperaturnom Potoke Gaza. Zhukauskas, A. Vil'nyus, USSR; Izdatel'stvo Mintis (1972). (In Russian).

The main assumptions in developing approximate methods of calculating a compressible turbulent boundary layer are practically unacceptable at high M numbers and temperature ratios of the main flow and boundary flow differing greatly from one. The temperature difference between layers leads to laminarization of the turbulent boundary layer which can cause a significant change in heat transfer. A viscous sublayer does not reflect the mechanism of turbulent exchange. In the region of the sublayer eddy pulsations occur periodically, and result in dynamic instability of the sublayer which increases in size sometimes, and also disappears entirely on other occasions. Thus the thickness of a laminar sublayer can only be considered as a quasistationary magnitude. The Reynolds analogy between heat exchange and resistance is not substantiated under conditions of high velocities and significant temperature differences between layers. Thus, all the "constants of turbulent exchange" require a particular experimental determination for these conditions. X rays, stroboscopic visualization, and various kinematic methods can be applied to the study of high-temperature gas flow. (SJR)

**279** MULTIREGIONAL HEAT-TRANSFER ANALYSIS OF LIQUID METAL FLOW THROUGH ECCENTRIC ANNULI. Wolf, L. (Technische Univ., Berlin). pp 61-74 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

An analytical, multiregional solution is presented of the problem of slug-flow heat transfer in an eccentric annulus with constant volume heat release in the internal rod and a thermally insulated outer tube surface obtained by using the point-matching technique in a modified bipolar coordinate system. Typical curves show the effect of eccentricity on the average Nusselt number for various radius ratios and thermal conductivity ratios, demonstrating the influence of additional, circumferential heat conduction in the walls. (auth)

**280** PROBELESS TEMPERATURE MEASUREMENTS AT THE WALL OF A LIQUID-METAL FLOW. Boyer, J.; Cambillard, E.; Huetz, J. (CNRS, Cachan, France). pp 75-79 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

In the particular case of flow of a liquid metal in a metallic tube, thermoelectric effects between the liquid and the solid can be used directly to measure the temperature at the wall. The procedure perfected and described here gives the wall temperature without local perturbation of the transport quantities. In addition, the response times are almost zero, allowing rapid changes of temperature to be followed. With this technique, it is possible to obtain the temperature fluctuations alone, whereas most devices for measuring temperature fluctuations have the disadvantage of being sensitive to fluctuations in both the velocity and the temperature at the same time. (auth)

**281** MIXED CONVECTION WITH SODIUM. Wendling, M.; Ricque, R.; Martin, R. (CENG, Grenoble, France). pp 81-92 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

Experimental heat transfer results obtained in a vertical asymmetrically heated rectangular channel at low Peclet numbers are presented. The effect of body forces is well correlated with the $G^*/Re$ ratio, and good agreement is found with previously published Russian data. Measurement of transverse temperature profiles shows that a fully developed regime may be defined in the channel. (auth)

**282** EXTENSIONS OF THE HEAT-TRANSFER COEFFICIENT CONCEPT FOR LIQUID-METAL TURBULENT FORCED CONVECTION WITH NONUNIFORM AND TRANSIENT HEAT FLUXES. Stein, R. P. (Argonne National Lab., IL). pp 93-112 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

Engineering relationships to account for turbulent forced convection heat transfer in ducts with axially nonuniform and transient heat fluxes and steady flow are discussed. These relationships are suggested as more accurate replacements for the simple heat-transfer coefficient expression $t_s - \bar{t} = q/h$ currently used in most engineering computations involving transients. The new relationships have the form $t_s - \bar{t} = q/h + (D^2 R_1/2k\beta) \times [(\partial q/\partial l) + (1/\bar{u})(\partial q/\partial \tau)] + \ldots$ where $R_1$ and $\beta$ are dimensionless coefficients which depend on Reynolds and Prandtl numbers and on duct shape. Tabulated values of these coefficients for the circular tube, parallel plane duct, and pin bundle are given over wide ranges of Reynolds and Prandtl numbers with emphasis on liquid metals. The equation given above is a specialized version of a more general expression. The source of this more general expression, the approximations upon which it is based, and its potential utility for practical engineering computations with liquid metals, are described. (auth)

283 TEMPERATURE FIELDS IN LIQUID-METAL-COOLED ROD ASSEMBLIES. Nijsing, R.; Eifler, W. (Joint Research Centre, Ispra, Italy). pp 115-149 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

A survey is given of heat transfer in rod assemblies cooled by axial, turbulent flow of liquid metal. The discussion is restricted to steady-state conditions, uniform heat generation in the rods, and fully developed flow and heat transfer. Theoretical considerations center on turbulent transport characteristics and on methodology of computation. An outline of recent work in this area by the authors is included. (auth)

284 EXPERIMENTAL STUDY OF HEAT TRANSFER TO LIQUID METALS FLOWING IN-LINE THROUGH TUBE BUNDLES. Graeber, H.; Rieger, M. (EURATOM, Ispra, Italy). pp 151-166 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From fourth international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

Nusselt numbers for the sodium–potassium alloy NaK (44/56) were obtained in the Peclet range Pe = 110 to 4300 for the three pitch-to-diameter ratios p/d = 1.25, 1.60, and 1.95 with two test sections each, one being built as a heater with electrically heated tubes and the other as a heat exchanger in a "figure-8" loop. Thirty-one tubes of d = 12 mm o.d. were arranged in an equilateral triangular lattice. Both the wall temperatures of the tubes and the fluid temperatures in the centres of the subchannels were measured by means of about eighty thermocouples per test section. The experimental results for constant heat flux satisfy the relation $Nu = a + b\ Pe^c$, where the constants $a = 0.25 + 6.20\ p/d$, $b = -0.007 + 0.032\ p/d$, and $c = 0.800 - 0.024\ p/d$. (auth)

285 COMPARISON OF ANALYTIC AND LUMPED-PARAMETER SOLUTIONS FOR STEADY-STATE HEAT TRANSFER IN FUEL-ROD ASSEMBLIES. Ginsberg, T.; France, D. M. (Argonne National Lab., IL). pp 167-178 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

A comparative study of analytic and lumped-parameter methods applied to steady-state heat transfer in nuclear fuel-rod assemblies is presented. The two methods were applied to an idealized, finite fuel-rod system which displays essential features of real fuel assemblies. Results of this investigation show that excellent agreement between the two methods can be obtained if theoretically predicted length scales are used as "effective mixing lengths" for conduction heat transfer in the COBRA-II lumped-parameter computer code. If, however, adjacent cellular (sub-channel) centroid-to-centroid distances are used to approximate the "effective mixing lengths," significant errors are generated in the temperature distributions predicted by lumped-parameter methods. Evidence is presented which indicates that these errors in the lumped-parameter solution can be reduced by subdividing the fuel assembly into a larger number of cells. (auth)

286 CALCULATING HEAT TRANSFER DURING LONGITUDINAL FLOW IN A ROD BUNDLE WITH SMALL RELATIVE PITCH. Borishanskii, V. M.; Gotovskii, M. A.; Firsova, E. V. pp 179-192 of Teploobmen Vysokotemperaturnom Potoke Gaza. Zhukauskas, A. (ed.). Vil'nyus, USSR; Izdatel'stvo Mintis (1972). (In Russian).

By the use of conformal representation, the condition of symmetry can be satisfied approximately for steady-state conditions of laminar and turbulent heat transfer for rod bundles with a relative pitch equal to one or almost one. Small but finite values of the Nusselt number can be calculated accurately when the heat flow becomes constant. The Nusselt number is given as a function of the small relative pitch from $s/d = 1$ to $s/d = 1.06$ at constant wall temperature and at constant heat flux. An analytical solution of thermal stabilization in a longitudinal bundle with $s/d = 1.0$ is presented for laminar and turbulent flows. A formula is given for the Nusselt number as a function of the Peclet number for laminar and turbulent flow in a longitudinal rod bundle. The calculation of heat transfer in bundles of small relative pitch is considerably simplified with the use of these formulas. (SJR)

287 THERMAL-HYDRAULIC ANALYSIS FOR FUEL ELEMENTS WITH LIQUID-METAL COOLING. Voj, P.; Markfort, D.; Ruppert, E. (INTERATOM, Cologne). pp 179-193 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

Analytical and experimental studies of the thermohydraulic behavior of a fuel rod bundle, cooled by steady-state, single-phase flow with special emphasis on liquid metals are described. Performance data on pressure drop, velocity distribution, and mixing rate of mock-up bundles are presented. Spacer grids typical of the design of the fuel subassembly of the SNR-300 are taken into account; and the result of an illustrative calculation of the temperature field in the spacer grid area is given. (auth)

288 EFFECTS OF GEOMETRIC ECCENTRICITY UPON AXIAL AND AZIMUTHAL TEMPERATURE DISTRIBUTIONS IN COOLANT, CLADDING, AND FUEL FOR SODIUM-COOLED ROD BUNDLES. Hofmann, F. (Kernforschungszentrum, Karlsruhe, Ger.). pp 195-205 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

A theoretical analysis is presented that permits calculation of two-dimensional velocity and temperature fields in the coolant, and three-dimensional temperature fields in the fuel and cladding. The analysis is applied to sodium as coolant with fully developed turbulent flow. Mixing of the coolant is calculated by appropriate equations for the diffusivities of momentum and energy. The results for the temperature and velocity fields are presented as functions of the eccentricity of the central rod in a hexagonal array, for the following cases: pitch to diameter ratio $P/D = 1.31$, and displacements of the rod $\xi = 0$, 0.22, and 0.66 mm. The results show that small displacements of the rod, in closely packed rod bundles, cause considerable temperature variations in the coolant and cladding on the rod periphery. (auth)

289 INFLUENCES OF HEATING METHODS AND ROD ECCENTRICITIES ON TEMPERATURE MEASUREMENT IN SODIUM EXPERIMENTS. Malang, S.; Rust, K.; Tschoeke, H. (Gesellschaft fuer Kernforschung m.b.H., Karlsruhe, Ger.). pp 207-217 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

The problem investigated concerns the accuracy with which the conditions in a sodium-cooled fuel rod bundle can be simulated by electrically heated rods in heat-transfer measurements. It turns out that up to 20% of error can be generated in the determination of the heat transfer coefficients, as a result of different structures of the simulators. The error caused by the disturbance of the heat flux due to a thermocouple with MgO insulation installed in the cladding tube is of the same order of magnitude. Much more accurate results can be achieved with thermocouples in which a BN insulation is used instead of MgO. (auth)

290 MULTIREGION ANALYSIS OF THE EFFECT OR LATERAL ROD DISPLACEMENT ON HEAT TRANSFER IN LAMINAR FLOW THROUGH CLOSELY PACKED REACTOR FUEL RODS. Hsu, C. J. (Brookhaven National Lab., Upton, NY). pp 219-237 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

A multiregion analysis of the effects of lateral rod displacement on the heat-transfer behavior of the displaced rod is presented, for longitudinal, laminar flow through closely packed rod bundles. Theoretical equations describing the temperature fields in the fuel core, cladding, and elemental coolant flow area are derived, and the series coefficients determined by constructing a set of orthonormal functions, followed by solving a matrix equation. Rod-average Nusselt numbers of the displaced rod are calculated, for the case of uniform fuel power density in the fuel core, as a function of P/D ratio, cladding thickness, thermal conductivity ratios and fractional displacement distance. (auth)

**291** FLOW AND TEMPERATURE DISTRIBUTIONS AROUND LOCAL COOLANT BLOCKAGES IN SODIUM-COOLED FUEL SUBASSEMBLIES. Kirsch, D.; Schleisiek, K. (Kernforschungszentrum, Karlsruhe, Ger.). pp 239-249 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

In an experimental investigation, the temperature distribution downstream of a blockage was measured with sodium flowing in an annular channel, the inner part of which formed six subchannels. The outer wall was an induction-heated circular tube. A distinct recirculation was found in the wake behind the blockage. The mean residence time of the fluid in the recirculation zone was calculated from the temperature measurements. A comparison between the sodium results and those obtained with water shows that heat conduction is negligible for the transport of heat between the flows inside and outside of the recirculation zone. Another series of experiments was performed in a water loop with a locally blocked rod bundle. The extent of the recirculation zone and the mass exchange between the flows inside and outside of this zone were measured. (auth)

**292** MIXING OF THE FLUID DUE TO HELICOIDAL WIRES ON FUEL PINS IN A TRIANGULAR ARRAY. Skok, J. (CEN, Cadarache, France). pp 251-262 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

The results of hydraulic similarity tests on mock-ups are presented, in order to examine the mixing effect due to helicoidal wires mounted on the pins of a bundle having a triangular array. The results obtained from experiments and calculation are compared, and predictions are given of the influence of mixing on the temperature distribution of sodium in two Phenix subassemblies, as compared to the results of a calculation assuming independent channels. (auth)

**293** NATURE OF LIQUID SUPERHEAT. Aladyev, I. T. (Power Inst., Moscow). pp 265-277 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

The problems of developing a strict theory on incipient boiling of liquids are discussed. Superheats in real conditions for incipient boiling of water under vacuum are compared with incipient boiling of alkali metals under pressure. Arguments are presented which lead to the conclusion that developing boiling theory on the basis of the "cavitation theory" are unpromising. (LCL)

**294** ASPECTS OF LIQUID-METAL SUPERHEAT AND THE EFFECTS ON DYNAMIC BOILING. Schultheiss, G. F. (Kernforschungszentrum, Karlsruhe, Ger.). pp 279-298 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

The technical background of liquid-metal superheat investigations is briefly given as an introduction. The term "superheat", which may have many different meanings, is explained in more detail. The problems of incipient boiling superheat are discussed. The thermohydraulic and physicochemical influences on initial nucleation of vapor bubbles are reviewed. Then nucleation models based on experimental results are discussed. Because of its basic influence, the results of superheat investigations are related to dynamic boiling problems. Finally, some goals of further work on incipient boiling superheat are proposed. (auth)

**295** MECHANISM OF NUCLEATION, SUPERHEATING, AND REDUCING EFFECTS ON THE ACTIVATION ENERGY OF NUCLEATION. Kottowski, H. M. (EURATOM–CCR, Ispra, Italy). pp 299-324 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

Nucleation can arise in two ways. The so-called thermal or homogeneous nucleation and athermal or inhomogeneous nucleation. In the case of the homogeneous nucleation the nucleus arises by local statistical entropy fluctuation, which brings together a number of molecules of high thermal energy to form an aggregate of critical size. The inhomogeneous nucleation, however, presumes the presence of latent nuclei, like cavities in the wall or impurities in the liquid. Emphasis is put on the discussion of a nucleation model which is able to describe the large variation in measured superheat data in sodium, as well as the nucleation mechanism, without the assumption of gas pockets or vapor as nucleation sites. (auth)

**296** RANDOM-WALK THEORY FOR THE INCEPTION OF BUBBLE GROWTH IN FLOWING LIQUID METALS AT A HEATED WALL. Bankoff, S. G. (Northwestern Univ., Evanston, IL). pp 325-335 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

It has been reported that the wall superheat for incipient boiling in a circulating liquid-metal system decreases markedly with increasing bulk velocity, possibly due to the influence of turbulent pressure fluctuations at the mouth of the wall cavity. A random-walk theory is developed to determine the expected waiting time between successive bubbles in a circulating liquid-metal system as a function of wall superheat and bulk velocity. For waiting times in the range of 0.033 to 0.1 sec (which correspond to the usual bubbling frequencies) and turbulent intensities of 0.05 to 0.3, the predicted velocities are almost an order of magnitude greater than the experimental ones for a given percentage decrease in wall superheat at incipient boiling of potassium. It is concluded that other effects are probably more significant in determining the observed results. (auth)

**297** INCIPIENT-BOILING SUPERHEATS FOR SODIUM: EFFECTS OF HISTORY, GAS CONTENT, AND APPROACH TO BOILING. Holtz, R. E.; Fauske, H. K.; Eggen, D. T. (Argonne National Lab., IL). pp 337-343 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

Experimental measurements of incipient-boiling superheats with sodium have been conducted with EBR-II primary sodium and no inert cover gas. These tests have shown that a large incipient superheat can result in a boiling surface losing its history; if the pressure-temperature history is applied for at least 20 min prior to the test run, the measured superheats show agreement with the pressure–temperature-history model if a ratio for the receding to advancing radii of curvature of 0.34 is employed; and the incipient-boiling superheat has been shown to be independent of the method of approach to boiling. (auth)

**298** EXPERIMENTAL STUDY OF HEAT TRANSFER DURING SODIUM BOILING UNDER CONDITIONS OF LOW PRESSURE AND NATURAL CONVECTION. Kovalev, S. A.; Zhukov, V. M. (Inst. for High Temperatures, Moscow). pp 347-354 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

An experimental study of heat transfer during sodium boiling on the surface of a horizontal tube under the conditions of low pressure and natural convection is described. (auth)

**299** CHARACTERISTICS OF HEAT-TRANSFER CRISIS DURING BOILING OF ALKALI METALS AND ORGANIC FLUIDS UNDER FREE CONVECTION CONDITIONS AT REDUCED PRESSURE. Avksentyuk, B. P.; Mamontova, N. N. (Inst. of Thermophysics, Novosibirsk, USSR). pp 355-362 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

Results are presented from experiments which measured the critical heat flux for the boiling of alkali metals, cesium and potassium, under free convection at pressures from 0.04 bars and for the boiling of ethanol in the pressure range from 0.05 to 2.5 bars. One test with three organic fluids, benzene, carbon tetrachloride, and ethanol, measured the critical heat flux as a function of heater diameter. Boiling and critical heat flux on surfaces greatly depleted of nucleation centers were also investigated. Photographs of the boiling process showed that, in addition to ordinary bubbles, an unstable vapor film was formed and destroyed on the surface. From this it was concluded that unstable boiling consists of a combination of ordinary nucleate boiling and volumetric flashing of the superheated layer on the heated surface and that the critical heat flux is strongly influenced by the condition of the surface. (LCL)

**300** BOILING OF MERCURY IN A VERTICAL TUBE UNDER FORCED-FLOW CONDITIONS. Schmuecker, H.; Grigull, U. (Technische Univ., Munich). pp 363-376 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

The hydrodynamic and boiling behavior of pure mercury in a vertical tube at low exit pressures was investigated. Stable and unstable operating modes were found. At the tube exit, maximum mass flow rate was always established. Heat transfer rates in the non-wetting system are in the range of the values obtained for mercury vapor cooling by forced convection. Visualization of the boiling zone and mercury two-phase flow was obtained by x-ray photography. Any similarity to well-known flow patterns was not found. (auth)

**301** INFLUENCE OF PRESSURE ON BOILING POTASSIUM HEAT TRANSFER IN TUBES. Gorlov, I. G.; Rzaev, A. I.; Khudiakov, V. F. (Power Inst., Moscow). pp 377-384 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

Recent heat transfer data obtained on potassium boiling in a straight tube under pressures up to $17 \times 10^{10}$ dynes/m$^2$ ($T_{saturation} \leq$ 1460°K) are discussed. (LCL)

**302** SOME FEATURES OF HEAT TRANSFER TO ALKALI METALS IN VAPOR-GENERATING TUBES. Dodonov, L. D.; Koroleva, V. S. (Power Inst., Moscow). pp 385-392 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

The general subject of heat transfer to alkali metals, such as K and Na, and water in vapor-generating tubes is discussed. The reason for the different correlations of data for water and metals in the dimensionless form, $\alpha_{exp}/\alpha_{wo} = f(1/X_{tt})$ is explained. The nature of intensification of heat transfer due to boiling in vapour-generating channels with $X > 0$ for liquids whose $Pr_{liq} \geq 0.7$ and for liquids whose $Pr_{liq} \ll 1$ is shown to be different. The main reason for the indicated features is the difference in the processes, controlling the rate of heat transfer to vapor–liquid flow, without boiling on the wall. For liquids with $Pr_{liq} \geq 0.7$, the heat transfer rate is determined primarily by thermal resistance of the liquid film on the wall, while for liquid metals it is mainly determined by the thermal resistance at the liquid–vapour interface. (auth)

**303** BOILING WITH LIQUID POTASSIUM IN SHORT ROD BUNDLES. Hoffman, H. W.; Huntley, W. R. (Oak Ridge National Lab., TN). pp 393-405 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

Results are presented from experiments performed to determine the critical heat flux with boiling potassium in upward forced flow in short, finite-array, rod bundles. The 30.5-cm-heated length test boiler was formed of seven 1.27-cm-OD heater elements arranged in triangular pattern at 20-mm separation within a heated shell contoured to simulate the next rod ring. Data obtained with two geometrically similar boilers at exit temperatures of 1033 to 1106°K showed critical fluxes of 132,500 to 268,000 W/m$^2$ with exit qualities of 58 to 93%. The effects of inlet subcooling, system pressure, shell heating, and central-rod excess heating on $\phi_{crit}$ were also investigated. (auth)

**304** LOCAL BOILING IN ROD BUNDLES: A THEORETICAL MODEL. Gast, K. (Kernforschungszentrum, Karlsruhe, Ger.). pp 407-416 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

A theoretical model is formulated to describe the process of local sodium boiling in a rod bundle geometry. The model is based on the assumption of single bubble boiling at substantial incipient-boiling superheat and considers the hydraulic characteristics of a fuel rod bundle. In the numerical calculation, the effects of liquid superheat and of the non-uniform temperature field in the disturbed region are investigated. The analytical results lead to the preliminary conclusion that, even at superheats as high as 150°C, individual vapor bubbles recondense completely within about 35 msec, that the fuel cladding inside the bubble is not overheated during this time, and that local boiling is unlikely to cause thermal hydraulic instability in the affected fuel assembly. Furthermore, it is shown that in case of considerable superheat the rapid volume change of individual vapor bubbles causes variations of the coolant flow rate at the sub-assembly outlet, which may be detected by means of an electromagnetic flowmeter. (auth)

**305** EXPERIMENTAL INVESTIGATION OF DRYOUT FOR SODIUM BOILING IN NARROW CHANNELS. Peppler, W. (Kernforschungszentrum, Karlsruhe, Ger.). pp 417-428 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

To establish the critical conditions that lead to the onset of dryout (DO), sodium boiling experiments were executed in an inductively heated test section. The hydraulic as well as the thermodynamic behavior of a fuel element subchannel was simulated. The heat flux was varied between 100 to 300 W/cm$^2$. The tests resulted in the determination of three different initial conditions for the onset of dryout. The first condition exists if, starting from stationary two-phase flow, the sodium film dries off locally. This type of dryout compares well with that observed in two-phase water flow. The other starting conditions are shown to be strongly interconnected with the stability characteristics of the boiling channel and the additional influence of incipient-boiling superheat. (auth)

**306** CRITICAL-FLOW EXPERIMENTS IN A FORCED-CONVECTION BOILING-SODIUM LOOP. Costa, J.; Charlety, P. (CEN, Grenoble, France). pp 429-439 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

Consequences of critical flows occurring in a flashing facility and in a forced-convection-boiling loop are presented. A method is derived to determine if critical conditions are reached at the exit of a boiling test section in a forced-convection loop. The method has been tested on a boiling-sodium loop and critical flow rates data are presented. (auth)

**307** HYDRODYNAMIC INSTABILITY IN PARALLEL CHANNELS WITH SODIUM TWO-PHASE FLOW. Peppler, W.; Schleisiek, K. (Kernforschungszentrum, Karlsruhe, Ger.). pp 441-449 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

The pressure drop of sodium two-phase flow was measured with two test sections of 4- and 9-mm hydraulic diameters. The results were compared with pressure-drop calculations using Chen's correlation for the liquid fraction as a function of the Lockhart–Martinelli parameter and Levy's model for the dependence of the two-phase pressure drop multiplier on the liquid fraction. The results agree rather well in the low-quality region, but less in the region above 0.15. The measured and calculated two-phase pressure-drop results formed the basis for a description of the hydrodynamic instability behavior of parallel channels. (auth)

**308** TRANSIENT LIQUID-METAL BOILING AND TWO-PHASE FLOW. Fauske, H. K. (Argonne National Lab., IL). pp 451-465 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

Experimental data indicate that transient liquid-metal boiling in narrow ducts is best characterized by the "slug-annular" flow regime; the early void growth being described by the usual slug flow approximation (uniform pressure within the bubble), while the annular flow condition (non-uniform pressure within the bubble) describes the later stages of voiding. Simple methods for estimating the incipient superheat, the spherical and cylindrical vapor growth, the liquid film thickness, the transition from slug to annular flow, and the occurrence of local dryout are discussed. (auth)

**309** FILM CONDENSATION OF LIQUID METALS. Rohsenow, W. M. (Massachusetts Inst. of Tech., Cambridge). pp 469-484 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

A survey of the state of data for condensation of metal vapors is presented and includes a discussion of the influence of measurement precision and traces of noncondensable gas on the observed results. A careful review of data suggests that the condensation coefficient $\sigma$ is very high, near 1.0, in the absence of noncondensable gas and that most condensation test systems are plagued to a greater or lesser degree by the presence of traces of noncondensable gas. (auth)

**310** EXPERIMENTAL STUDY OF NATURAL CONVECTION HEAT TRANSFER FROM VERTICAL FLAT PLATES IN MERCURY. White, D. H.; Welty, J. R.; Hurt, J. C. (Oregon State Univ., Corvallis). pp 485-501 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

Velocity and temperature profiles adjacent to a constant heat flux, vertical flat plate within a pool of liquid mercury have been measured and compared with integral, similarity, and perturbation solutions. In addition, an empirical heat-transfer equation is presented. Trends and comparisons indicate: that no available heat-transfer analytical result matches the experimental data; that velocity and temperature profiles are functions of both the modified Grashof number and the location along the plate, a result predicted by perturbation solutions but not by integral or similarity solutions; and that the empirical equation suggests higher heat transfer than earlier correlations predict. (auth)

**311** SODIUM ENTRAINMENT IN AN ARGON FLOW: THE EVAPORATION AND CONDENSATION PROCESSES. Egleme, M.; Michel, A. (Belgonucleaire, Brussels). pp 503-516 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

Experimental studies of the properties of Ar mixed with Na vapor were undertaken to determine how effectively Na can be cleaned from spent fuel assemblies of Na-cooled reactors by evaporation in flowing Ar. These studies are significant in the development of systems for cooling spent fuel elements removed from Na-cooled reactors. The tests showed that: at high temperatures of sodium (350°C) and argon (430°C), evaporation can be obtained which reduces the initial amount of sodium by a factor of 2 in 20 min; and complex geometries such as grids entrain a large amount of sodium which cannot be removed by flowing dry argon because the surface-volume ratio is very low for efficient evaporation, and the dynamic effects of the gas flow are small as soon as parts of the cell are free. It was concluded that very little "cleaning" by evaporation can be expected because the Ar must be heated above 400°C with a controlled oxygen content to cause Na evaporation sufficient to clean fuel bundles, and, at high temperature, there are many objections to the use of such a process including the alteration of the sensitized cladding surface. However, much was learned about the behavior of Na vapor and aerosols entrained by Ar which will be useful in the development of trapping systems and in the prevention of consideration in Na–Ar systems. (LCL)

**312** CONVECTION IN LIQUID METALS PRODUCED BY HIGH-FREQUENCY ELECTRIC CURRENTS. Luikov, A. V.; Berkovskii, B. M.; Quang, V. Z. (Inst. of Heat and Mass Transfer, Minsk). pp 517-526 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

A theoretical analysis is made of the problem of convection produced by high-frequency currents in electroconducting liquids, i.e., liquid metals and water, and of the effects of this induced convection on heat transfer in the conducting media. (LCL)

**313** MIXED CONVECTION IN THE SHELL OF A HORIZONTAL NA-TO-NaK HEAT EXCHANGER. Skupinskii, E. (EURATOM, Saclay, France). pp 527-537 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

Experimental results obtained on a Na-to-NaK heat exchanger operated in the 88-to-1500 Peclet number range are presented. For the present test section, operating in the horizontal position (equivalent diameter $D_H = 7.24 \times 10^{-2}$ m), an important influence of free convection at Peclet numbers lower than 800 was observed. The effect is characterized by a noticeable sodium stratification, with temperature differences on the shell in some cases of nearly 90°C, and by a decrease in the average heat-exchange rate, although locally, for a value of $L/D_H = 68.5$, Nusselt numbers are higher than forced-convection values. The temperature distributions of the sodium on the shell-side and the shell-side mixed-convection Nusselt numbers compared with those for forced convection are shown. (auth)

**314** THEORETICAL INVESTIGATION OF NON-EQUILIBRIUM FLOW OF VAPORIZING POTASSIUM THROUGH A CONVERGENT-DIVERGENT NOZZLE. Staedtke, H. (Technische Univ., Berlin). pp 539-552 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

With the flow of one-component, two-phase mixtures with low vapor qualities through convergent–divergent nozzles, there is very rapid expansion and evaporation, and considerable deviations from the equilibrium state can occur. The extents of these deviations are determined by the exchange processes of mass, momentum and heat. A complete set of equations is given for describing this phenomenon. The emphasis lies in the investigation of the exchange processes between the continuous gas phase and the dispersed liquid phase. Numerical evaluations are given for potassium and for water. The following are calculated for the expansion process: vapor quality, temperatures of vapor and liquid phases, their deviations from the saturation temperature and the different velocities of both phases (slip). (auth)

**315** HEAT TRANSFER IN TURBULENT FLOW OF LIQUID METALS IN A MAGNETIC FIELD. Petukhov, B. S.; Zhilin, V. G. (Inst. for High Temperatures, Moscow). pp 553-568 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

Heat transfer behavior in turbulent flow of liquid metals in a magnetic field is of scientific interest because the study of turbulent MHD flows, and the heat transfer in such flows, makes it possible to better understand the characteristics of turbulent heat transfer in general. Knowledge of such heat transfer behavior is of practical interest in the design of electromagnetic pumps, MHD generators, and other MHD devices. Results from theoretical and experimental research on heat transfer in turbulent flow of liquid metals in both longitudinal and transverse magnetic fields are analyzed, and further research problems are outlined. (LCL)

**316** CURRENT LIQUID-METAL HEAT TRANSFER RESEARCH IN JAPAN. Aoki, S. (Tokyo Inst. of Tech.). pp 569-587 of Progress in Heat and Mass Transfer. Vol. 7. Dwyer, O. E. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

From 4th international seminar on heat and mass transfer in liquid metals; Trojir, Yugoslavia (6 Sep 1971). See CONF-710942-.

For the purpose of developing liquid-metal-cooled fast reactors, many investigations have been carried out in Japan. In the matter of convective heat transfer, eddy diffusivities for heat and momentum transfers were studied and applied to the correlation of heat-transfer coefficients for sodium. The heat-transfer coefficients were measured for both uniform and sinusoidal axial heat flux shapes. In the case of boiling heat transfer, boiling curve, bubble growth velocity for mercury, the influence of dissolved gas on the incipient-boiling superheat and the power spectrum of pressure fluctuation for sodium convective boiling have been investigated. (auth)

**317** DETERMINATION OF HEAT FLOW SHAPE FACTORS FOR HOLLOW, REGULAR POLYGONAL PRISMS. Laura, P. A.; Susemihl, E. A. (Universidad Nacional del Sur, Bahia Blanca, Argentina). Nucl. Eng. Des.; 25: No. 3, 409-412(1973).

Steady-state heat flow in domains of regular polygonal shape with inner circular boundaries is analyzed. The method of conformal mapping is used and an approximate expression is derived for the shape factor. (auth)

**318** INDUCTION OF COOLANT CROSSFLOW IN A FLAT CHANNEL BY WALL FINS. Fraser, J. P. (Knolls Atomic Power Lab., Schenectady, NY). Nucl. Eng. Des.; 25: No. 3, 403-408 (1973).

The concept of using oblique, oppositely slanted fins on the walls of a flat coolant channel to set up a circulatory crossflow in addition to the axial flow is examined analytically. Predicted crossflow angles are compared to measured crossflow angles for three fin heights at one constant fin angle. (auth)

**319** CALCULATION OF TWO-PHASE PRESSURE LOSSES. Beattie, D. R. H. (Australian Atomic Energy Commission Research Establishment, Sutherland). Nucl. Eng. Des.; 25: No. 3, 395-402(1973).

The calculation of axial differences in static pressure for two-phase flow along a pipe is discussed in relation to the evaluation of two-phase friction. Two-phase friction equations derived from mixing length theory are summarized. The equations compare favorably with data covering the following fluid conditions at the wall: bubble flow; wavy gas-liquid interface; flow with very small bubbles; attached wall bubbles; and dry wall. (auth)

## Materials Testing

*Refer also to abstracts 1986, 2013, 2014, 2088, and 2406.*

**320** (ANL/MSD-7) RECOMMENDED RADIOGRAPHIC INSPECTION APPROACH FOR COMPLETE REACTOR FUEL SUBASSEMBLIES OF FFTF SIZE. Berger, H.; Lapinski, N. P. (Argonne National Lab., Ill. (USA)). Jun 1973. 16p. AT.

A high-energy x-radiographic method of inspecting complete 217 fuel-element subassemblies for the Fast Flux Test Facility is described. A multiple-film laminagraphic technique permits the viewing of any fuel row within the assembly with minimum interference from other fuel rows. Voids as small as 1 mm are shown to be detectable anywhere within the assembly. Specific techniques and equipment are recommended, and suggestions for further improvements in the technique are given. (auth)

**321** (BNWL-1770) LOW-FLUX NEUTRON IMAGING. Swinth, K. L.; Nichols, L. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1973. Contract AT(45-1)-1830. 5p. Dep. NTIS $4.00.

Judicious use of scintillation screens greatly improves the capabilities for low-flux neutron imaging. Room temperature, cooled $^6$LiF−ZnS(Ag) and gadolinium oxysulfide ($Gd_2O_2S:Tb$) were evaluated for direct exposures, and x-ray intensifying screens were evaluated with dysprosium and europium transfer screens. Although gadolinium oxysulfide provides improved resolution, it requires seven times the imaging time of $^6$LiF−ZnS(Ag). Studies indicate that use of intensifying screens during transfer processes decreases the flux for a given density by about 30% and provides contrast enhancement. It was shown that cooling of scintillator-film combinations reduces reciprocity failure effects and in these experiments decreased direct exposure times ($Gd_2O_2S:Tb$) by up to 80%. (auth)

**322** (CONF-731014-1) OPTIMIZATION OF EDDY-CURRENT MEASUREMENTS OF COIL-TO-CONDUCTOR SPACING. Smith, J. H.; Dodd, C. V. (Oak Ridge National Lab., Tenn. (USA)). 1973. 16p. Dep. NTIS $3.00.

From annual fall conference of the American society for nondestructive testing; Chicago, Illinois, USA (1 Oct 1973).

A detailed analysis of the problem of measurement of coil-to-conductor spacing (lift-off) is performed. Flat, pancake-shaped coils have the greatest sensitivity to lift-off, although a compromise must be made between coil thickness and dc resistive drift. For any given value of nominal lift-off, there is an optimum value of coil size for maximum sensitivity. Other variables such as operating frequency and thickness of the conductor are also considered. (auth)

**323** (HEDL-SA-584) 70mm ROLL FILM CAMERA SYSTEM FOR REMOTE METALLOGRAPHY. Gruber, W. J. (Hanford Engineering Development Lab., Richland, Wash. (USA)). [nd]. Contract AT(45-1)-2170. 20p. (CONF-731101-7). Dep. NTIS $3.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum and Nuclear Energy Exhibition; San Francisco, California, USA (11 Nov 1973).

An automatically sequenced 70mm roll film camera system was adapted with minimal modification for use with remote metallographs to record high magnification (25 to 750X) photomosaics. The system is also applicable for other photorecording requiring large numbers of photomicrographs. The system can be used with nearly any metallograph and features interchangeable components that are available as shelf items. A variety of readily available standard photographic films are used for recording and conventional processing equipment and procedures are employed to process film and print photomicrographs. A substantial unit cost reduction for photomosaics has been realized in the eighteen months that the system has been in operation. (auth)

**324** ALPHA RADIOGRAPHY. Srivastava, D. S. Sci. Rep.; 10: No. 5, 225-226(May 1973).

The principle, methods, and prospects for plastic track detectors providing a quick and simple method for making alpha-ray patterns of alpha-active samples in thin plastic foils, even in the presence of a large flux of beta particles and gamma-rays to which they are insensitive, are described. The method does not require any dark room treatment. This method has proved to be effective for checking the uniformity of alpha sources and for finding the diffusion of plutonium in the reactor fuel rods and their containers. It is expected that this simple method can advantageously replace photoemulsions in the works related with the study of radioactivity of crystal faces, autoradiography of alloys, study of diffusion of radioactive materials in porous media, and in many biological applications such as localization of lead, bismuth, polonium, astatine, uranium, plutonium and other transuranic elements. The best etching solutions and temperatures for quick alpha radiographic work are listed. (INIS)

**325** SECOND INTERNATIONAL CONFERENCE ON PRESSURE VESSEL TECHNOLOGY. Part I. Design and Analysis. Conference Held at San Antonio, Texas, October 1–4, 1973. New York; American Society of Mechanical Engineers (1973). 631p. (CONF-731003-P1). $40.00.

Forty-five papers presented at the conference are included. A separate abstract was prepared for each of 14. Three papers have been abstracted previously in NSA. The remaining 28 papers dealing mainly with stress analysis were not within the scope of NSA. (LCL)

*For abstracts of individual papers see: 259–263, 1987, 1988, 1994, 2000, 2004, 2014, 2088, 2095, and 2096.*

**326** SECOND INTERNATIONAL CONFERENCE ON PRESSURE VESSEL TECHNOLOGY. Part II. Materials, Fabrication, and Inspection. Conference Held at San Antonio, Texas, October 1-4, 1973. New York; American Society of Mechanical Engineers (1973). 595p. (CONF-731003-P2). $40.00.

Forty-four papers presented at the conference are included. A separate abstract was prepared for each of 17. The remaining 27 papers dealing with materials testing techniques, fatigue of vessels and components, and the fabrication of and materials for pressure vessels and piping were not within the scope of NSA. (LCL)

*For abstracts of individual papers see: 254–258, 327–336, 1986, and 2013.*

**327** ACOUSTIC EMISSION AND PRESSURE VESSEL FAILURE. Bentley, P. G.; Burton, E. J.; Cowan, A.; Dawson, D. G.; Ingham, T. (United Kingdom Atomic Energy Authority, Risley, Eng.). pp 643-654 of Second International Conference on Pressure Vessel Technology. II. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P2.

The development of the UKAEA acoustic emission monitoring system has continued, directed towards its use to prevent pressure vessel failure in materials of general engineering practice. The acoustic facility, SWEL, can locate sources on large vessels to ±3 inches and has a two-dimensional display, on line, of the emission sources. Measurements have been made of the location of artificial and natural defects in the EBOR vessel, USA. The emission, after the first cycle, from cracks grown by pressure cycling of artificial defects in experimental vessels, 3 inches and 1 inch thick, was shown to be very low. A systematic investigation was made of the acoustic emission from a range of steels and a ranking derived in terms of fracture toughness and tensile strength. The use of acoustic emission as a general inspection tool was surveyed. Its present complexity and cost limits its use to specific, large vessels, especially those in which failure could lead to a high cost from loss of production. In-service monitoring is not considered yet to be practicable and this view has been confirmed from background noise measurements on British Gas-Cooled Reactors. The main present use for the technique is on the validation of pressure vessels with defects in brittle regions during pressurization tests, before operation and during shutdown periods. Doubts have been raised about the signal strengths from flaws in the parent plate of ductile materials. Further tests are required on experimental vessels taken to failure to establish confidence. (auth)

**328** INSPECTION OF STEEL PRESSURE VESSELS BY ACOUSTIC EMISSION. Chretien, N.; Bernard, P.; Barrachin, B. (CEN de Saclay, Gif-sur-Yvette, France). pp 655-667 of Second International Conference on Pressure Vessel Technology. II. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P2.

It is of primary importance to the safety of industrial plants to be able to monitor or inspect steel pressure vessels to determine changes which occur in existing defects and to detect the presence of new defects. The application of the acoustic emission method to such monitoring is discussed in terms of: means for detecting stress waves, i.e., acoustic emission; quantitative evaluation of measured emissions; data on the relation between fracture mechanisms and acoustic emission in steel; rupture mechanisms on test pressure vessels; the performance of acoustic emission testing during hydraulic tests on industrial pressure vessels; and recent laboratory research developments. It is concluded that acoustic emission testing is advantageous for monitoring pressure vessel defects because it is a global control method and can be applied to pressurized equipment, it is an efficient monitoring method easy to adapt to normal plant operating conditions, and it detects only defects that are evoluting and consequently hazardous. (LCL)

**329** RESULTS OF MOCK-UP TEST ON ULTRASONIC IN-SERVICE INSPECTION TOOL FOR NUCLEAR REACTOR VESSEL. Yamaguchi, T.; Fukushima, Y.; Yamamoto, M.; Endo, E.; Yoshida, Y. (Mitsubishi Heavy Industries Ltd., Kobe, Japan). pp 685-699 of Second International Conference on Pressure Vessel Technology. II. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P2.

The results are discussed of the mock-up test made with the in-service inspection tool developed for a pressurized water reactor vessel (PWR). Used in the flaw detecting method of this device were a normal beam method, angle beam method, and pitch-catch method. Satisfactory results were obtained in the tests of flaw detectability and repeatability in all of these methods. The interiors of the nuclear reactor vessel were lined with an overlay cladding of stainless steel. Although this cladding is detrimental to flaw detection, the F/B method is effective in eliminating the effect of the cladding. (auth)

**330** IMPROVEMENTS IN ULTRASONIC TESTING METHODS OF WELDS, SPECIALLY IN THE PRESENCE OF AUSTENITIC STEEL CLADDING. Saglio, R.; Prot, A. C. (CEN de Saclay, Gif-sur-Yvette, France). pp 701-713 of Second International Conference on Pressure Vessel Technology. II. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P2.

In an attempt to overcome problems related to the ultrasonic testing of stainless steel clad components, studies were carried out at Saclay to develop a new method known as the "Constant Time" ultrasonic method. This method and ultrasonic transducer technology are discussed. Tests of the method and equipment were performed on T-welds in the Phenix reactor cover-plate and on thick plates clad with a stainless steel weld overlay. The results of these tests and the effects of transducer parameters on the results are described. (LCL)

**331** NONDESTRUCTIVE TESTING OF UNFIRED PRESSURE VESSELS. Tenbusch, T.; Haas, R. (Technischer Ueberwachungs Verein, Essen). pp 715-722 of Second International Conference on Pressure Vessel Technology. II. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P2.

The testing philosophy leading to the German specifications for nondestructive testing especially of welds in unfired pressure vessels is described. German specifications regard ultrasonic testing as more reliable than radiographic methods while the ASME-code gives preference to radiographic inspection. The performance of the method is reduced to a measuring technique with well described rules for the operator. The results obtained are compared with the acceptance criteria without considering the nature of the reflectors. (auth)

**332** INVESTIGATION ON LOW-CYCLE FATIGUE STRENGTH OF PIPING COMPONENTS. Udoguchi, T.; Asada, Y. (Tokyo Univ.). pp 773-783 of Second International Conference on Pressure Vessel Technology. II. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P2.

An investigation was carried out on the fatigue strength of branch pipe connections and curved pipes for nuclear power pipings. Steel model specimens of piping components were subjected to cyclic internal pressure, in-plane and out-of-plane bending moments, and expansion force loadings. Total strain ranges of piping component specimens were measured with wire strain gages at locations where fatigue failures were apt to occur. The fatigue strength of piping components was evaluated by relating the fatigue life and the range of the local strain to the fatigue strength of small smooth specimens of the pipe material. On the basis of the test results, suggestions are made for improving the design of piping components which are subjected to cyclic loadings. (auth)

**333** FATIGUE CRACK PROPAGATION FROM WELD DEFECT IN 100 mm THICK JOINT. Iida, K. (Tokyo Univ.); Fujii, E. pp 923-942 of Second International Conference on Pressure Vessel Technology. II. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P2.

One of the problems relating to fatigue strength of a welded joint containing a weld defect is the evaluation of propagation life of a crack started from the defect. The propagation behavior of a fatigue crack from a deliberately introduced internal weld defect in 100 mm thick transverse joint of A533B steel was examined by a betatron, and the propagation rate was analyzed. It was observed that the propagation rates from an internal weld defect were higher than for a through-thickness notch at a given range of stress intensity. (auth)

**334** USE OF COD AS A MEASURE OF FRACTURE INITIATION IN STEEL PRESSURE VESSELS. Kirby, N; Ingham, T.; Cowan, A. (United Kingdom Atomic Energy Authority, Risley, Eng.). pp 943-951 of Second International Conference on Pressure Vessel Technology. II. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P2.

Tests to failure on 1 in. thick wide plates and cylindrical pressure vessels containing through thickness defects have been used to demonstrate the range of validity of crack opening displacement (COD) as a fracture concept. Tests on steels with yield strengths ranging from 33,000 to 71,000 psi yield strength have shown that close correspondence is obtained between the failure stresses in defected wide plates and pressure vessels with those predicted from the COD determined in bend tests. As the COD in the bend test becomes greater, failure is preceded by stable ductile tearing and prediction of failure conditions becomes increasingly more inaccurate but at these toughnesses "leak before break" conditions are probable. The effect of thickness on material toughness was investigated in tests on two 3 in. thick pressure vessels. In the vessel geometry used, the opposing effects of thickness on fracture toughness and rigidity may be isolated, with that of toughness predominating at the lower temperatures. (auth)

**335** STUDY OF CRACK INITIATION-ARRESTING CONDITIONS IN PRESSURE VESSEL MODELS WITH RESPECT TO ACCUMULATED ENERGY. Brumovsky, M.; Filip, R.; Kalna, K.; Stepanek, S.; Urban, A. (Skoda Works, Plzen, Czech.). pp 953-969 of Second International Conference on Pressure Vessel Technology. II. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P2.

An extensive research effort was performed for studying the safety criteria in nuclear reactor pressure vessels. The last four years of research work are described and the most important results from this study discussed. An analysis is presented of the influence of accumulated energy in the pressurizing medium on the crack arrest temperature, which is taken as the basic criterion for pressure vessel (or pipeline) safety. Analysis of all results shows that at some characteristic temperature cracks, either brittle or fast shear, are arrested. Comparison of this temperature with other temperature criteria is introduced. (auth)

**336** CRACK ARREST IN AN INCREASING K-FIELD. Crosley, P. B.; Ripling, E. J. (Materials Research Lab., Inc., Glenwood, IL). pp 995-1005 of Second International Conference on Pressure Vessel Technology. II. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P2.

Crack arrest mechanisms in low and intermediate strength steels under conditions of constant loading rate and increasing loading, or stress intensity ($K_I$) rate were studied in order to define a limiting rate which would result in conservative fracture toughness values. The test equipment and methods are described. Contoured double-cantilever-beam (DCB) specimens were used in the zero-K-gradient tests. Single-edge-notched (SEN) specimens were used for measuring toughness in the positive-K-gradient tests. From the limited test series, it was concluded that crack arrest toughness ($K_{Ia}$) as measured in an increasing K field with SEN specimens is the same as $K_{Ia}$ measured with a contoured DCB specimen having a zero-K-gradient. (LCL)

**337** NONDESTRUCTIVE METHODS OF WELD INSPECTION. Pope, C. W. Aust. Weld. J.; 17: No. 5, 111-115(1973).

Increasing demands are being made for more detailed data on weld defects. The two principal methods of nondestructive testing, radiography and ultrasonics are discussed together with the selection of methods and specification of required weld quality. Finally, the importance of competent NDT operators is stressed. (auth)

**338** NONDESTRUCTIVE TESTING BY ACOUSTIC EMISSION. Becht, J.; Eienblaetter, J.; Jax, P. (Battelle Institut eV, Frankfurt am Main). Z. Werkstofftech.; 4: No. 6, 306-314(1973). (In German).

After the discussion of the physical principles and the experimental procedures of acoustic emission techniques, examples of their applicability and capability are presented. These concern plastic deformation of metals (ferrous and non-ferrous), crack formation during heat treatment for stress relief, crack formation during cyclic loading, control of weld processes (pressure and periodic testing and surveillance of reactor pressure vessels), stress-corrosion cracks, and finally microcrack formation in different fiber-reinforced composite materials. Advantages and disadvantages of the method are compared with those of other NDT methods. (GE)

**339** DYNAMIC RESPONSE OF MATERIALS TO INTENSE IMPULSIVE LOADING. Chou, P. C.; Hopkins, A. K. (eds.). Wright Patterson AFB, OH; Air Force Materials Laboratory (1972). 562p.

The study of the dynamic response of materials, primarily solids, to intensive impulse loadings, both mechanical impact and thermodynamic energy input, for durations in the order of microseconds is discussed in detail. The subjects discussed include: basic conservation laws from the classical fluid mechanics point of view; the propagation of steady discontinuous stress waves; shock waves as studied from the thermodynamics and physics point of view; constitutive relations and wave propagation in solids from a modern continuum mechanics viewpoint; method of characteristics in unsteady material response problems; introduction to numerical analysis; experimental techniques and instrumentation; and applications dealing with shock waves and high-pressure dynamic material response for scientific, engineering, and military purposes. (LCL)

## Nuclear Explosions

*Refer also to abstracts 374, 375, 427, 428, and 691.*

**340** (JAB-99-92) LOW-RISE BUILDING DAMAGE CAUSED BY AN EARTHQUAKE AND UNDERGROUND EXPLOSION. Scholl, R. E.; Farhoomand, I. (Blume (John A.) and Associates Research Div., San Francisco, Calif. (USA)). Oct 1973. Contract AT(26-1)-99. 41p. Dep. NTIS $4.00.

An investigation was conducted to compare low-rise building damage caused by an earthquake with that caused by an underground nuclear explosion. The methodology used in deriving the motion–damage relationships is described. The derived motion–damage relationships are given both in terms of the incidence of damage (damage ratio) and damage cost (damage cost factor). Motion–damage relationships derived from the earthquake data are compared with similar data for low-rise buildings subjected to the ground motion of an underground nuclear explosion. Overall results show that for the same spectral acceleration the earthquake caused slightly more damage. Differences in ground motion characteristics for the two types of disturbances provide the most probable explanation for this discrepancy. (auth)

**341** (NVO-137) PLANNING AND OPERATIONS DIRECTIVE, GASBUGGY: 1973 PRODUCTION TESTING PROGRAM. (USAEC Nevada Operations Office, Las Vegas). Sep 1973. 24p. (PNE-G-84). Dep. NTIS $3.25.

The purpose of the 1973 Gasbuggy testing program was to determine whether the reservoir characteristics have changed with time, i.e., 40 months after shut-in. Gasbuggy was detonated on Dec. 10, 1967 as an experiment to evaluate the feasibility of natural gas production stimulation using nuclear explosives. The postshot reentry and initial production testing phase occurred in 1968 and 1969. The planning, organization, operating procedures, management, and funding of the 1973 production testing program are presented. (LCL)

**342** (UCRL-51417) GENERATION OF RAYLEIGH WAVES BY UNDERGROUND OF NUCLEAR EXPLOSIONS: AN EXAMINATION OF THE EFFECT OF SPALL IMPACT AND SITE CONFIGURATION. Viecelli, J. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 Jul 1973. Contract W-7405-eng-48. 75p. Dep. NTIS $5.75.

Thesis.

The effect of spall impact, site configuration, and the material properties of rocks at the blast site on the generation of Rayleigh waves by underground nuclear explosions was examined by experimental and computational methods. The hypothesis was that the impact of earth and rock, i.e., spall, falling back after being kicked up by the initial shock wave of an explosion is a source of surface waves observed from explosions. A comparison of amplitudes derived from spall momentum with observed Rayleigh amplitudes at ranges of from 50 to 500 km showed that the spall has sufficient impulse to account for these waves. In the site configuration studies it was found that the strongest signal was produced by a horizontally distributed source placed beneath a mountain, and the weakest signal was produced by a concentrated source placed beneath a flat plain. The horizontal dimension of the source had the biggest effect on the Rayleigh amplitude. Based on laboratory measurements of the mechanical properties of rocks in drill cores from the Boxcar and Gasbuggy sites, calculations were made of the spall impulse and surface displacement profiles from these explosions. The numerically obtained profiles were in reasonable agreement with values inferred from accelerometer data obtained at the sites. (LCL)

**343** (UCRL-51447) MECHANICAL PROPERTIES OF NUGGET SANDSTONE. Schock, R. N.; Abey, A. E.; Bonner, B. P.; Duba, A.; Heard, H. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 28 Aug 1973. Contract W-7405-eng-48. 19p. Dep. NTIS $4.00.

The mechanical properties of Nugget sandstone have been determined from a number of independent measurements at pressures up to 30 kbar. Pressure-volume, strength, uniaxial stress, and uniaxial strain tests yield the failure surface and effective moduli as a function of stress state, i.e., mean pressure and shear stress. Acoustic velocity determinations provide the effective moduli for low-amplitude dynamic waves. At atmospheric pressure the initial effective bulk modulus in tests with applied differential stresses (~40 kbar) differs from that determined hydrostatically (23 kbar). This and a large pressure derivative of the shear modulus at low pressure are believed to be due to an abundance of cracks with low aspect ratios. The initial effective shear modulus of about 55 kbar increases rapidly with the closing of cracks. At 1 kbar confining pressure, a shear modulus of about 120 kbar is determined in both uniaxial stress and uniaxial strain experiments. The rock has an ultimate strength comparable to granite (1.2 kbar unconfined) and exhibits brittle behavior at failure to the highest mean pressure studied (14 kbar). Failure is preceded by dilatant behavior. (auth)

**344** (UCRL-51453) NUCLEAR IN SITU RECOVERY OF OIL FROM OIL SHALE. Lewis, A. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 Sep 1973. Contract W-7405-eng-48. 56p. Dep. NTIS $5.45.

A plan is presented for production of oil by retorting oil shale in situ after breaking it with underground nuclear explosives. Reserves of oil shale of thickness and grade suitable (greater than 20 gal/ton) for this process occur in the Piceance Creek Basin of Colorado, and are estimated to contain 640 billion barrels of oil in place. Cost projections indicate that this oil could be produced at a price ranging from $2.00 to $3.30 at the wellhead with a 20% rate of return on investment (discounted cash flow). The price and production rate vary with oil shale thickness. At a rate of 32 nuclear chimneys per year in oil shale ranging in thickness from 1000 to 2000 ft, production varies from 28 million bbl/yr ($3.30/bbl) to 121 million bbl/yr ($2.00/bbl). Capital requirements for this in situ process are estimated to be 20 times less than those required by a surface retorting process. Environmental problems such as the need to dispose of large volumes of waste rock associated with conventional mining and surface retorting of oil shale would be largely avoided. Problems of seismic ground motion and possible contamination of the oil and groundwater appear manageable. The necessity for government action arising from federal ownership of the resource as well as the requirement for a significant government contribution to the development of the nuclear in situ retorting technology requires either government development of the resource or a policy defining how industry and government may jointly develop it. The potential contribution to the energy resources of the nation is so large that this method of recovery from oil shale must be considered. (auth)

**345** MEASURING UNDERGROUND EXPLOSIONS. Gribbin, J. Indian East. Eng.; 115: No. 2, 75-76(Feb 1973).

Refined computer analysis of the seismographic records collected on earthquakes and underground nuclear explosions is yielding valuable information on the structure of the Earth's crust and also on the depths of the explosions beneath the surface of the earth. Since the earthquakes originate from much greater depths than any artificial explosion, the time lag of the signals received by the seismometers is used to evaluate the depth of the nuclear explosion or earthquake. With the demonstrated accuracy of signal separation of better than half a second, the UKAE team are able to assess confidently the firing depth of explosions at a depth of 0.75 km or more. This is ample to distinguish explosions from earthquakes, so the technique must have immediate applications to the question of detecting underground nuclear tests. (INIS)

**346** SCATTERING OF P WAVES UNDER THE MONTANA LASA. Aki, K. (Massachusetts Inst. of Tech., Cambridge). J. Geophys. Res.; 78: No. 8, 1334-1346(10 Mar 1973).

The variations of amplitude and time delay of teleseismic P waves across the Montana Lasa (Large Aperture Seismic Array) were interpreted as being due to scattering by a random inhomogeneity in the Earth's crust under the array. The prediction of the Chernov [1960] theory explains well the observed statistical properties of P waves with a frequency of 0.5 Hz. The inhomogeneity under Lasa has a correlation distance of about 10 km, with a fractional rms velocity fluctuation of 4% extending to a depth of about 60 km. The turbidity coefficient under Lasa at 0.5 Hz is 0.008 $km^{-1}$, which is much greater than the values ($10^{-3}$ to $10^{-4}$ $km^{-1}$ at 5 to 10 Hz) observed for refracted waves in the crust and upper mantle in the USSR by Nikolayev and his colleagues. The scattering under Lasa is so strong that the condition for the Born approximation is violated for frequencies higher than 0.5 Hz. Accordingly, the observed statistical properties of 1-Hz waves show systematic departure from the prediction of the Chernov theory. (auth)

**347** SPALLATION AND THE GENERATION OF SURFACE WAVES BY AN UNDERGROUND EXPLOSION. Viecelli, J.A. (Lawrence Livermore Laboratory, University of California, Livermore, California, 94550). J. Geophys. Res. 78: No. 14, 2475-2487 (10 May 1973).

Underground nuclear explosions, even though they are thoroughly contained, invariably produce spallation. This mass of earth and rock, kicked up by the initial shock wave, falls back within a second or two. It is possible that the surface waves observed from explosions originate from the impact of this material. This hypothesis has been investigated, first, by estimating the spall impulse from accelerometer data, computing the surface wave amplitudes consistent with this impulse, and comparing the results with observed amplitudes and, second, by performing computer explosion simulation experiments with and without spallation and comparing the amplitudes of the resulting surface waves. The comparison of the amplitudes consistent with the spall momentum with the observed Rayleigh amplitudes at ranges of 50-500 km indicates that the spall has sufficient impulse to account for these waves. The computer simulation experiments show that the Rayleigh amplitudes corresponding to realistic inelastic spallation have several times the amplitude of Rayleigh waves computed from purely elastic behavior. The surface wave for the spallation case is also delayed relative to the wave from the elastic source. (auth)

**348** SEISMIC SURFACE WAVES FROM AMCHITKA ISLAND TEST SITE EVENTS AND THEIR RELATION TO SOURCE MECHANISM. von Seggern, D. (Seismic Data Laboratory, Teledyne Geotech, Alexandria, Virginia, 23314). J. Geophys. Res. 78: No. 14, 2467-2474 (10 May 1973).

Relative shear-wave excitation equivalent to large Nevada Test Site underground explosions was detected for the Amchitka Island test Milrow. Use of Milrow Love waves as match filters enabled detection of these waves on Longshot and Milrow collapse recordings as well. Mechanisms other than tectonic strain release must have produced the Love waves. The Rayleigh waves from the collapse were oppositely polarized relative to Milrow and were delayed by a time increment approximately equal to the expected free-fall time through the postexplosion cavity. A small delay (1 to 2 sec) in the initial phase of long-period components of the source function was detected for Milrow relative to Longshot. A Rayleigh-wave amplitude ratio for Milrow and Longshot was precisely determined by match filtering; this ratio agreed almost exactly with amplitude scaling proportional to the cube root of yield. (auth)

## Safety Engineering

*Refer also to abstracts 152 and 496.*

**349** (AERE-R-6711) X-RAY SAFETY EQUIPMENT AND PROCEDURES IN THE MATERIALS PHYSICS DIVISION, A.E.R.E., HARWELL. Sampson, C. F. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Feb 1971. 25p. Dep. NTIS (U. S. Sales Only) $3.25. UK 35 pence.

A description is given of safety devices and procedures which have been adopted in the x-ray crystallographic laboratory of the Materials Physics Division, A.E.R.E., Harwell. The safety devices have been mounted on Mueller, Philips PW 1008 and PW 1016 x-ray tubeshields together with the modifications necessary for single crystal and powder x-ray diffraction cameras to fit these attachments. A description is given also of environmental enclosures surrounding these x-ray tubeshields and crystallographic instruments. The safety features outlined have been developed to conform with the United Kingdom Department of Employment and Productivity Code of Practice together with additional requirements set down by the Health Physics and Medical Division, A.E.R.E., Harwell. (auth)

## Vacuum Engineering

*Refer also to abstract 962.*

# ENVIRONMENTAL AND EARTH SCIENCES

**350** (AD-754784) SUPPORT OF ENVIRONMENTAL PROGRAM PLANNING. Mackin, J. L.; Schmidt, R. A. (comps.) (Stanford Research Inst., Menlo Park, Calif. (USA)). Oct 1972. Contract N00014-72-C-0445. 391p. NTIS.

Principal environmental problem areas of importance to the Department of Defense were identified and possible approaches to advanced research projects directed toward solutions of these problems were suggested to provide partial source material in support of ARPA's research program planning. Topics regarding environmental impact analysis, resources management, air quality, water quality, materials handling and disposal, data management, and special problems were included. For each topic, information was organized according to statement of the problem, state of the art, present activities and organization, implications for the DoD, and recommendations for further studies. (GRA)

**351** (BNL-18173) ADAPTATION: THE ECOSYSTEM. Woodwell, G. M. (Brookhaven National Lab., Upton, N. Y. (USA)). 1973. 46p. (CONF-730650-2). Dep. NTIS $4.50.

From American Institute of Biological Sciences meeting; Amherst, Massachusetts, USA (21 Jun 1973).

**352** (BNWL-SA-4655) BIBLIOGRAPHY OF ENVIRONMENTAL RESEARCH: ECOSYSTEMS DEPARTMENT, 1952–1973. Vaughan, B. E.; (and others). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1973. 108p.

A bibliography of environmental research is presented which consists of 1349 items published between 1952 and mid-1973 by 56 past and present staff members of the Ecosystems Dept., Battelle Pacific Northwest Laboratories. The material is arranged by alphabetical listing of author. Under each author, publications are listed chronologically by publication date in the categories of: journal articles, books, reports, and patents. No indexes are included. (LCL)

## Minerals and Ores

*Refer also to abstracts 416 and 813.*

**353** PRIMARY GEOCHEMICAL AUREOLES IN U–Mo IN ACIDIC VOLCANIC ROCKS. Rossman, G. I.; Sychev, I. V.; Tarkhanova, G. A. Izv. Vyssh. Ucheb. Zaved., Geol. Razved.; No. 7, 60-68(Jul 1972). (In Russian).

Uranium–molybdenum lenticular-stratified hydrothermal deposits are timed at the middle Devon volcanic-sedimentary rock strata and connected with fault disturbances, widely developing at this boundary. The ores are of pure uranium or uranium–molybdenum. The processes of oxidation, reduction to the formation of leaching-out zones, oxidation, and cementation appear widely in the deposits. The study of the initial geochemical aureoles in the rocks was done by sampling of well cores, mine walls, and outcroppings. The samples were analyzed by semiquantitative, approximate-quantitative, spectral, and radiometric methods. The samples of the bearing profiles were verified by quantitative, spectral, and chemical analysis. The changes of the ore-containing rocks were studied simultaneously. The results of the $\gamma$ logging of wells and the surface $\gamma$ removal were studied during the construction of the scattering aureoles. For determination of the bonding of element satellites with ore-forming elements correlation analysis in samples of ore and aureoles was used. All positive bonds were explained by the presence of given paragenesis, arising during ore, extrusion, and hypergenic processes and by the admixture of individual elements in the ore-forming minerals. The distribution of elements in the different horizontal slices, characterizing the different positions of the aureoles with reference to the ores and modern surfaces, was studied. On the basis of this study the following conclusions were made: (a) in the upper part of the ores and aureoles the ore-forming elements were bound more diversely than in the lower; (b) in the hypergenesis zone the real composition of the initial geochemical aureoles undergoes changes; (c) in the zone of the emergence of ore-bearing rock in the day surface of the ground the aureoles inherit correlation bonds typical of endogenetic processes. (tr-auth)

**354** CHARACTERISTIC FEATURES OF HYDROTHERMAL MINERALIZATION IN A URANIUM DEPOSIT LOCATED IN A SECONDARY QUARTZITE MASSIF. Yakovlev, P. D.; Malyutin, S. A. (Moscow Geological Inst.). Izv. Akad. Nauk SSSR, Ser. Geol.; No. 1, 71-75(Jan 1973). (In Russian).

Uranite sulfide ore manifestations are confined to a line of volcanic structures and are closely related to the subvolcanic rock of liparite formation. They are found in the peripheral part of the secondary quartzite massif. Unlike known industrial deposits of Mo-U ore, formations on ore-bearing areas are developed secondary quartzes of an early mineralization stage and with the appearance of hematitization of the rock, accompanied by relatively high U, Th, Zr, and rare earth contents. This mineralization is in the independent stage, preceding the uranium-sulfide mineralization and separate from the earlier secondary quartzite with internal felsitic, laparitic, and spherulitic porphries and eruptive brecchias. Impregnated uranite-pitchblende sulfide ores are formed by a metasomatic route, in which there is a markedly favorable effect on ore deposition of hydrothermal quartz-sericitic metasomatites of different stages and pre-ore beresites. (tr-auth)

**355** ISHIKAWAITE: THE FIRST FIND IN THE USSR. Makarochkin, B. A. Zap. Vses. Mineral. Obshchest.; No. 4, 474-475(Apr 1972). (In Russian).

Ishikawaite is a uranium variety of samarskite. It was detected in 1953 in one of the veins of granite pegmatites of the Urals in a zone of development of pyroxene-amphibole-garnet gneissoid granite and biotite syenites. It was found in the form of single crystals or clusters of grains in paragenesis with garnets, sphrene, columbite, monazite, and other minerals at the boundary zone of the vein. It has a black color with surface coated with yellow crust of weathering products. The line is dark brown. The brightness is resin. The break is blistered. It is brittle. The specific weight is 5.90 (determined by pycnometer). The formula of the ishikawaite is $(U, Th, Ce, Y)\ (Fe^{2+}, Nb, Ta, Ti)_2 0_6$. (tr-auth)

**356** ISOTOPIC COMPOSITION OF SULFUR IN URANIUM ROLLS AND ITS GENETIC SIGNIFICANCE. Belyi, V. M.; Vinogradov, V. N.; Lisitsyn, A. K. Litol. Polez. Iskop.; No. 6, 42-53(Jun 1973). (In Russian).

The isotopic composition of the sulfur in sulfides associated with uranium ores and in sulfates of stratal waters of ore-bearing layers was studied in individual ore bodies. It was established that sulfides in uranium rolls are formed by the action of hydrogen sulfide originating primarily in situ in the biogenic reduction of sulfates of the stratal waters. The distribution of sulfur isotopes in the individual rolls is explained by the conditions in which the individual ore bodies are formed. (tr-auth)

**357** ACCESSORY MINERALS IN THE K. HARITONOV ALKALINE MASSIF (WESTERN ZABAHKAL'E). Chuprov, V. V. Zap. Vses. Mineral. Obshchest.; No. 4, 430-437(Apr 1972). (In Russian).

The characteristics of the accessory minerals in the rock massif are reported. According to the association of the primary accessory minerals the alkali syenites and subalkali granitoids pertain to the sphene-ilmenite-magnetite type with constant presence of zircon and apatite. Zircons, magnetites, and apatites, precipitated in the early and later magmatic stage of crystallization, differ according to typomorphic characteristics. Data from the quantitative and semiquantitative analysis of the accessory minerals showed an increased concentration of Zr, Nb, Th, Sc, Y, La, Ce, and Yb. Zn, Pb, Cu, Bi, Sn, and Be appear as characteristic elements. A regular increase of their concentration in the accessory minerals from granitoids of the concluding intrusion phases was noted. Analogous regularity was found in the distribution of Sc, P, and Th. The accumulation of these elements in the minerals from the latest intrusion formations is closely connected with the relative increase of the concentration in the granitoids of zircons, rutile, anatase, fluorite, and pyrite as well as with the appearance of new accessory minerals: thorite, orthite, and galena. Under favorable conditions their accumulation in local zones is possible. (tr-auth)

**358** TEHNIKA BEZOPASNOSTI I PROIZVODSTVENNAJA SNITARIJA NA PREDPRIJATIJAH CVETNOJ METALLURGII. (Occupational Safety and Health in Non-Ferrous Smelting and Refining). Lebedeva, K. V. Moscow; Izdatel'stvo Metallurgija (1972). 231p. 0.51 rouble.

General requirements and legislation in the USSR concerning occupational safety and health are reviewed. Topics discussed in detail include organization of worker protection; causes of occupational accidents; reporting and investigation; personal protective equipment; the hazards of toxic substances, noise, and vibration; safety and health problems related to the choice of a plant location; and the design and construction of buildings and installations where radioactive substances and ionizing radiations are used; lighting; ventilation; dust control; electrical safety; manual handling and transport handling; and steam boiler and pressure-fall safety. (Occup. Saf. Health Abstr.)

## Radioactive Effluents

*Refer also to abstracts 370, 399, 2212, and 2213.*

**359** (DP-MS-73-32) INTEGRATED ENVIRONMENTAL MODELING SYSTEM FOR NOBLE GAS RELEASES AT THE SAVANNAH RIVER PLANT. Cooper, R. E. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). [nd]. Contract AT(07-2)-1. 27p. (CONF-730915-5). Dep. NTIS $3.50.

From symposium on noble gases; Las Vegas, Nevada, USA (24 Sep 1973).

There are continuous and intermittent releases of radioactive gases to the atmosphere at the Savannah River Plant. Of these releases, the noble gases constitute about 11% of the total man-rem exposure to the population out to a distance of 100 km. Although SRP has an extensive radiological monitoring program, an environmental modeling system is necessary for adequately estimating effects on the environment. The integrated environmental modeling system in use at SRP consists of a series of computer programs that generate and use a library of environmental effects data as a function of azimuth and distance. Annual average atmospheric dispersion and azimuthal distribution of material assumed to be released as unit sources is estimated from a 2-year meteorological data base assuming an arbitrary point of origin. The basic library of data consists of: ground-level concentrations according to isotope and whole body gamma dose calculations, that account for total spatial distribution, at discrete energy levels. These data are normalized to tritium measurements and are subsequently used to generate similar library data that pertain to specific source locations but always with respect to the same population grid. Thus, the total additive effects from all source points, both on and off site, may be estimated. The final program uses the library data to estimate population exposure for specified releases and source points for nuclides of interest (including noble gases). Multiple source points are considered within a single pass to obtain the integrated effects from all sources. The total man-rem exposure to the local population out to 100 km resulting from SRP operation is about 0.4% of that received from natural activity. The noble gases contribute about 11% of this fraction. Current efforts at SRP are directed toward improving the above methods and toward applied research to develop, verify, and use techniques out to several 100 km. (auth)

**360** (ORO-4328-1, pp 17-23) GROSS BETA AND TRITIUM ANALYSES OF SEDIMENT AND WATER NEAR CALVERT CLIFFS. Brisson, R. J. Aug 1973.

In ecological effects of nuclear steam electric station operations on estuarine systems. Volume I.

As part of the cooperative benthic program off Calvert Cliffs, sediment aliquots are obtained from samples provided by the Natural Resources Institute's, benthic animal-sediment program. After the sediment sample was prepared, aliquots were run through a NaI crystal system for gross beta analysis. In addition, surface (S) and bottom (B) water samples obtained at the same station were analyzed for tritium. Completed determinations from May, August, and November 1972 are tabulated. (auth)

**361** ATOMIC ENERGY INDUSTRY'S APPROACH TO ENVIRONMENTAL PROTECTION. Boswell, R. W. (Australian Atomic Energy Commission, Lucas Heights). At. Energy Aust.; 16: No. 2, 2-5(Apr 1973).

The nuclear industry's control of both radioactive and nonradioactive pollution to the biosphere and its general approach to the assessment of total environmental impact are described. A discussion of site selection for a nuclear power station with regard to minimizing any environmental effects is also included. (auth)

## Radioactivity Monitoring and Transport

*Refer also to abstracts 633, 787, 2137, 2178, 2204, 2217, and 2290.*

**362** (AERE-PR/HPM-17) HEALTH PHYSICS AND MEDICAL DIVISION PROGRESS REPORT, JANUARY–DECEMBER 1972. Johnston, J. E.; Suttar, T. V. (eds.) (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Jul 1973. 73p. Dep. NTIS (U. S. Sales Only) $5.75. UK £ 1.50.

The subject is dealt with in sections: inhalation toxicology and bioanalytical studies, whole-body counting, radiation physics, special investigations and cellular radiobiology, neutron dosimetry, personnel dosimetry service, analytical radiation spectrometry and data processing, fallout, reactor aerosols, medical services (x-ray department), environmental analysis project (quantitative chemical analysis), atmospheric pollution, autoradiographic detection of fingerprints using $^{35}SO_2$, publications. (UK)

**363** (ARMS-68.6.5) AERIAL RADIOLOGICAL MEASURING SURVEY OF THE AREA SURROUNDING THE LA CROSSE BOILING WATER REACTOR, GENOA, WISCONSIN, JULY 1968. (EG and G, Inc., Las Vegas, Nev. (USA)). Oct 1973. 12p. (EGG-1183-1584). Dep. NTIS $4.00.

The Aerial Radiological Measuring System (ARMS) was used to survey the area surrounding the La Crosse Boiling Water Reactor during July 1968. The survey measured terrestrial gamma radiation. A high-sensitivity detection system collected gamma spectral and gross-count data. The data were then computer processed into a map of a 625 sq. mile area showing isoexposure contours 3 ft above the ground. Exposure rates and isotopes identified are consistent with normal background radiation. (auth)

**364** (ARMS-70.6.6) AERIAL RADIOLOGICAL MEASURING SURVEY OF THE AREA SURROUNDING THE MONTICELLO NUCLEAR GENERATING PLANT, MONTICELLO, MINNESOTA, AUGUST 1970. (EG and G, Inc., Las Vegas, Nev. (USA)). Sep 1973. 12p. Dep. NTIS $4.00.

The Aerial Radiological Measuring System (ARMS) was used to survey the Monticello Nuclear Generating Plant and surrounding area during Aug. 1970. The survey measured terrestrial background gamma radiation. A high-sensitivity detection system collected gamma spectral and gross-count data. The data were then computer processed into a map of a 625 sq. mile area showing isoexposure contours 3 ft above the ground. Results indicated the presence of isotopes normally found in the background radiation throughout the United States. (auth)

**365** (ARMS-70.6.7) AERIAL RADIOLOGICAL MEASURING SURVEY OF THE AREA SURROUNDING THE ENRICO FERMI ATOMIC POWER PLANT, MONROE, MICHIGAN, SEPTEMBER 1970. (EG and G, Inc., Las Vegas, Nev. (USA)). Sep.1973. 12p. Dep. NTIS $4.00.

The Aerial Radiological Measuring System (ARMS) was used to survey the Enrico Fermi Atomic Power Plant and surrounding area during Sept. 1970. The survey measured terrestrial background gamma radiation and included a plume track of the stack release gases. A high-sensitivity detection system collected gamma spectral and gross-count data. The data were then computer processed into a map of a 277 sq. mile area showing isoexposure contours 3 ft above ground. Results indicated the presence of isotopes normally found in the background radiation throughout the United States. The plume track revealed no radiation above background levels. (auth)

**366** (ARMS-70.6.8) AERIAL RADIOLOGICAL MEASURING SURVEY OF THE AREA SURROUNDING THE PALISADES PLANT, SOUTH HAVEN, MICHIGAN, JULY 29, 1970. (EG and G, Inc., Las Vegas, Nev. (USA)). Oct 1973. 12p. (EGG-1183-1585). Dep. NTIS $4.00.

The Aerial Radiological Measuring System (ARMS) was used to survey the area surrounding the Palisades Plant during July 1970. A high-sensitivity detection system collected gamma spectral and gross-count data. The data were then computer processed into a map of a 300 sq. mile area showing isoexposure contours 3 ft. above the ground. Exposure rates and isotopes identified are consistent with normal terrestrial background radiation. (auth)

**367** (ARMS-70.6.11) AERIAL RADIOLOGICAL MEASURING SURVEY OF THE AREA SURROUNDING THE VERMONT YANKEE GENERATING STATION AND THE YANKEE NUCLEAR POWER STATION, SEPTEMBER 18, 1970. (EG and G, Inc., Las Vegas, Nev. (USA)). Oct 1973. 24p. (EGG-1183-1581). Dep. NTIS $4.00.

The Aerial Radiological Measuring System (ARMS) was used to survey the area surrounding the Vermont Yankee Generating Station and the Yankee Nuclear Power Station during September 1970. The survey measured terrestrial gamma radiation. A high-sensitivity detection system collected spectral and gross-count data for the flyable portions of the 625 sq. mile survey area. Isotopes identified and exposure rates are consistent with normal background radiation. (auth)

**368** (ARMS-72.6.4) AERIAL RADIOLOGICAL MEASURING SURVEY OF THE FORT CALHOUN STATION, FORT CALHOUN, NEBRASKA, AUGUST 9–10, 1972. (EG and G, Inc., Las Vegas, Nev. (USA)). Oct 1973. 12p. (EGG-1183-1596). Dep. NTIS $4.00.

The Aerial Radiological Measuring System (ARMS) was used to survey the area surrounding the Fort Calhoun Station during Aug. 1972. The survey measured terrestrial gamma radiation. A high-sensitivity detection system collected gamma spectral and gross-count data. The data were then computer processed into a map of a 625 sq. mile area showing isoexposure contours 3 ft above the ground. Exposure rates and isotopes identified are consistent with normal terrestrial background. (auth)

**369** (BNWL-1669) ENVIRONMENTAL SURVEILLANCE AT HANFORD FOR CY-1970. Corley, J. P. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1973. Contract AT(45-1)-1830. 97p. Dep. NTIS $5.45.

The primary mission at the Hanford site of the Atomic Energy Commission has been the production of plutonium. Activities have included nuclear fuel fabrication, plutonium production and test reactor operation, chemical separations of irradiated fuels, laboratory support and research, waste storage and disposal, and plant support operations. In recent years, privately owned facilities located within the Hanford site boundaries have included a power generating station, an office building, and a radioactive waste burial site. Low-level wastes from Hanford operations, fallout from nuclear weapons testing, naturally-occurring radioelements, and cosmic radiation all contribute to radioactivity in the Hanford environs. The most significant Hanford contributions to off-plant radioactivity and consequent population doses have usually originated with reactor cooling water released to the Columbia River. Between December 1964 and December 1970 all but one (KE) of the eight production reactors with once-through cooling were deactivated. The only other production reactor remaining in operation at Hanford during 1970 was N Reactor, which has a closed primary cooling loop and releases only minor quantities of radioactivity to the river. The 1970 Hanford environmental surveillance program indicated continued compliance of the Hanford contractors and their operations with applicable environmental standards. Data are reported on the radioactivity in samples of groundwater, surface water, drinking water, atmosphere, water fowl, fish, milk, meat, and vegetables collected in the Hanford area. The data were used to calculate the annual radiation dose to the skeleton, gastrointestinal tract, thyroid, and whole body of human residents of the area. (CH)

**370** (BNWL-1669-ADD) ENVIRONMENTAL SURVEILLANCE AT HANFORD FOR CY-1970 DATA. Corley, J. P. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Aug 1973. Contract AT(45-1)-1830. 117p. Dep. NTIS $8.00.

Tabulated results from both analyses of environmental samples and from radiological measurements in the Hanford environs during 1970 are presented in these appendixes to BNWL Report No. 1669. Data are included on the chemical characteristics of the Columbia River water and on the concentrations of radioisotopes in Columbia River water, drinking water, shellfish from Willapa Bay, the atmosphere, farm produce and commercial foodstuffs, and soil and vegetation. (LCL)

**371** (CONF-710567--, pp 108-111, PAPER 10) ENVIRONMENTAL MONITORING. Jain, M. P. Aug 1971.

From seminar on recommendations of the international commission on radiological protection; New Delhi, India (12 May 1971).

The ICRP recommendations for the radiation monitoring of the environs of installations that may possibly release radioactivity to the environment are reviewed. Monitoring programs should include preoperational surveys to determine the possible routes by which radioactivity released during plant operations could reach human populations, routine surveys, and emergency programs for use in the event of accidental release of radioactivity. Critical population groups should be identified in such a way as to be representative of the more highly exposed individuals in the population and factors should be identified that influence the potential dangers, such as age distribution, dietary habits, occupations, and types of dwellings. (CH)

**372** (EGG-1183-1592) ARMS: RADIOLOGICAL SURVEY OF THE AREA SURROUNDING THE NINE MILE POINT NUCLEAR STATION, SCRIBA, NEW YORK. Date of Survey: 20 September 1969. Technical Report No. L-1106. (EG and G, Inc., Las Vegas, Nev. (USA)). 9 May 1973. Contract AT(29-1)-1183. 19p. Dep. NTIS $3.00.

The Aerial Radiological Measuring System (ARMS) was used to survey the area surrounding the Nine Mile Point Nuclear Station during September 1969. The survey measured terrestrial background gamma radiation. A high-sensitivity detection system collected gamma spectral and gross-count data. The data were then computer processed into a map of a 600 square mile area showing isoexposure contours three feet above the ground. Exposure rates and isotopes identified are consistent with normal terrestrial background radiation. (auth)

**373** (EGG-1183-1593) ARMS: RADIOLOGICAL SURVEY OF THE AREA SURROUNDING THE PEACH BOTTOM ATOMIC POWER STATION, PEACH BOTTOM, PENNSYLVANIA. Date of Survey: 5, 7, 9, 11 August 1969. Technical Report No. L-1107. (EG and G, Inc., Las Vegas, Nev. (USA)). 10 May 1973. Contract AT(29-1)-1183. 21p. Dep. NTIS $3.00.

The Aerial Radiological Measuring System (ARMS) was used to survey the area surrounding the Peach Bottom Atomic Power Station during August 1969. The survey measured terrestrial background gamma radiation. A high-sensitivity detection system collected gamma-ray spectral and gross-count data. The data were then computer processed into a map of an 800 square mile area showing isoexposure contours three feet above the ground. Exposure rates and isotopes identified are consistent with normal terrestrial background radiation. (auth)

**374** (LA-UR-73-1291) DISTRIBUTION OF ENVIRONMENTAL PLUTONIUM IN THE TRINITY SITE ECOSYSTEM AFTER 27 YEARS. Hakonson, T. E.; Johnson, L. J. (Los Alamos Scientific Lab., N. Mex. (USA)). 1973. 6p. (CONF-730907-14). Dep. NTIS $3.00.

From 3rd international congress of the International Radiation Protection Association meeting; Washington, District of Columbia, USA (9 Sep 1973).

Results are presented for a radioecological survey of the Trinity Site environs, where the world's first (July 1945) atomic bomb was detonated. The temporal behavior of the low environmental levels of the plutonium produced by this detonation are discussed. The data from this study were compared with similar data obtained in the Trinity Site environs nearly 20 years ago. The major change which was observed was an increased migration of Pu into the soils. Concentrations of Pu in vegetation and rodents were too low to make valid comparisons. (auth)

**375** (NVO-294-6) ON-SITE RADIOLOGICAL SAFETY AND MEDICAL SERVICES. Final Report. Project CANNIKIN. (Eberline Instrument Corp., Santa Fe, N. Mex. (USA)). Aug 1973. Contract AT(26-1)-294. 37p. Dep. NTIS $4.00.

Radiological safety support for Project CANNIKIN included installation, calibration, and operation of remote area monitoring and air sampling systems, personnel dosimetry, environmental sampling, survey and monitoring activities, and exclusion area control. All of the above activities indicated no release of radioactive materials to the environment. Medical coverage included treatment of occupational and nonoccupational injuries and/or diseases of the island population, patient evacuations, surveillance of island food, water, and sanitary services and other activities. (CH)

**376** (RLO-2225-T-18-6) WORLD DISTRIBUTION OF ENVIRONMENTAL TRITIUM. Schell, W. R.; Sauzay, G. (Washington Univ., Seattle (USA). Lab. of Radiation Ecology; CEA Centre d'Etudes Nucleaires de Saclay, 91 Gif-sur-Yvette (France)). 1973. Contract AT(45-1)-2225. 30p. (CONF-731110-3; SM-181/34). Dep. NTIS $3.50.

From symposium on the physical behavior of radioactive containment in the atmosphere; Vienna, Austria (12 Nov 1973).

A systematic distribution of tritium on a global scale was determined from an evaluation of the precipitation data provided by the IAEA–WMO Environmental Isotope Program during the 1964, 1965, and 1966 fallout year. The tritium concentration in precipitation increased from the equator to the poles at an exponential rate. In the Northern Hemisphere the rate doubled about every 13° of latitude and in the Southern Hemisphere about every 16° of latitude. The global distribution of tritium was unlike $^{90}$Sr, which reached maximum values at mid-latitudes. The tritium concentration was found to be three to four times greater in continental than in ocean precipitation at the same latitude, with some dependence on topography. The residence time for tritium in the Northern Hemisphere was estimated to be one year and was derived from the decrease in the annual tritium concentration during the period 1963 to 1967 when no new injections of tritium from thermonuclear detonations occurred. The average transit time from the Northern to the Southern Hemisphere was found by integration of the yearly deposition rates in each hemisphere and was estimated to be about four years. The distribution of cosmic-ray-produced tritium was estimated, using the slopes of the Northern and Southern Hemisphere doubling rates. The few samples of water, wine, and ice cores that represented tritium in precipitation prior to the first thermonuclear detonation in 1952 agreed reasonably well with the proposed model of the world distribution of tritium. (auth)

**377** CESIUM-37 ACCUMULATION AND DISTRIBUTION IN PLANTS AND SOILS OF AN ALPINE COMMUNITY OF UTAH.

Wagner, W. W. Salt Lake City, UT; Univ. of Utah (1973). 286p. University Microfilms Order No. 73-21,508.

Thesis (Ph. D.).

The accumulation and distribution of cesium-137 was measured in the plants and soils of the alpine community in the Uinta Mountains of Northeastern Utah from 1963 to 1968. Cesium concentration averaged 206 ± 75 $nCi/m^2$ (to a depth of 4 centimeters) in the soils of the high elevation sites and was significantly higher than lowland sites averaging 84 ± 14 $nCi/m^2$. Soils of cirques at the heads of glacial basins where snow and wind-borne particulate matter accumulated averaged 240 $nCi/m^2$ and were significantly higher than soils on sites toward the middle of glacial basins which averaged 145 $nCi/m^2$. Within the cirque, soils at the base of the talus face averaged 334 $nCi/m^2$ and were significantly higher in cesium-137 concentration than soils at various distances from the rock-soil juncture that averaged between 188 and 194 $nCi/m^2$. The significance of wind in transporting soil and associated cesium-137 from unstable sites on ridge tops to accumulation sites on the lee sides of ridges was noted. Concentration of cesium-137 was significantly correlated with organic matter content of the soil. Cesium concentration in soils decreased rapidly with depth. The top four centimeters contained 92 to 95 percent of the cesium present in a 30 centimeter profile, indicating an extremely slow downward movement. Meadow vegetation in the higher elevation alpine community averaged 18 pCi/g dry weight in 1964 and decreased to 6 pCi/g in 1968, which was 14 to 36 times higher than meadow vegetation on arable soils in the valleys in the respective years. The lowest concentration measured in 1963 was 0.5 pCi/g in mushrooms growing under partial protection of forest canopy. The highest concentration measured in 1963 was over 100 pCi/g in a moss growing in wet boggy environments and a moss growing in flowing streams. Residence half-times measured from 1964 to 1968 ranged from approximately one year in most of the annual vegetation types to approximately six years in perennial rock lichen. Cesium-137 was measured in sediment samples carried by meltwater runoff. Concentration of the sediment samples ranged between 26 and 91 pCi/g. Algae samples collected in flowing streams within the alpine area maintained a rather consistent cesium concentration of approximately 21 pCi/g dry weight from 1964 to 1968. Water moss samples collected from the same stream decreased from approximately 100 pCi/g in 1964 to 19 pCi/g in 1968. (Diss. Abstr.)

**378** COMPARATIVE ACCUMULATION OF FALLOUT RADIONUCLIDES ON CONTRASTING PLANT SURFACES. Moore, J. L. Salt Lake City, UT; Univ. of Utah (1973). 187p. University Microfilms Order No. 73-21,374.

Thesis (Ph. D.).

Plant surface morphology, gross plant surface area, growth form and selective nuclide retention characteristics directly affect fallout nuclide accumulation on plants and should be considered in contamination studies. Fallout radionuclides, $^{125}$Sb, $^{106}$Ru, $^{137}$Cs, and $^{54}$Mn were identified on four plant species at six collecting stations in Salt Lake and Tooele Valleys of Utah during the summers of 1964 and 1965. The test species have contrasting characteristics. Two were low-growing, the highly villous Astragalus utahensis Torr. & Gray and the glabrous Gutierrezia lucida Greene. Two were high-growing, the densely pubescent sage, Artemisia tridentata Nutt. and the near glabrous oak Quercus gambelii Nutt. One kilogram leaf samples of each species collected at each station were counted. Contamination levels were reported for each radionuclide on each test species at each station for 1964 and 1965 both in terms of weight and gross surface area. The contamination activity on the contrasting plants was compared. The highly villous Astragalus had the greatest range of differences. The near glabrous oak accumulated more contamination in terms of weight than the pubescent sage. When surface area was used as the basis of comparison, both species accumulated nearly the same contamination except for $^{125}$Sb. This exception suggested selective accumulation of nuclides. Alfalfa, 1st, 2nd and 3rd crop, and chopped corn silage from stations located in the major agricultural areas of Utah and sampled each year from 1961 to 1967 were compared for accumulation of $^{90}$Sr and $^{137}$Cs in terms of pCi/kg. Each crop of the highly pubescent alfalfa had higher contamination levels than the more glabrous corn. Plants collected in the high Uinta Mountains were ranked as to pubescence and their contamination compared. As plant pubescence increased, contamination increased. In order to test selective radionuclide accumulation, ratios were constructed of the mean activity of all possible bifold combinations of the four radionuclides present on the plants. These ratios were compared by species. Multiple-range tests were also made to determine significant differences. These tests showed Astragalus accumulated more $^{137}$Cs than the other species and oak has an affinity for $^{125}$Sb. The highly villous nature of Astragalus combined with its decumbent life form makes it a very efficient trap for secondary aerosols. Many other factors could influence selective accumulation, and these effects may be factorial in nature. (Diss. Abstr.)

**379** TEN YEARS OF RESEARCH ON THE CYCLE OF SOME RADIONUCLIDES IN THE MARINE ENVIRONMENT. Schreiber, B. (Univ., Parma, Italy). Ateneo Parmense, Sez. 2. Acta Natur.; 7: No. 1, 1-12(1971). (In Italian). (RT/BIO-(72)28).

Several radionuclides ($^{90}$Sr, $^{137}$Cs, $^{144}$Ce, $^{155}$Eu, $^{147}$Pm, $^{54}$Mn, and $^{226}$Ra) were determined in plankton and seawater samples: their content is in relation to the radioactive fallout intensity. Particular attention was paid to $^{90}$Sr the presence of which in the plankton may be correlated with the Acantharia frequency. Such a radionuclide was determined in many marine substrata also. The same radionuclides were found in the coastal marine sediments of the Ligurian and North Adriatic Seas. The radioactivity due to their presence in the various layers was correlated with the radioactive fallout and suggested to us an hypothesis on the accumulation rate of marine sediments in the coastal zones. In 1968 the radioecological study of Taranto Gulf was begun. The value of the radioactivity measurements in such a zone has a practical importance as in future a reprocessing plant of the nuclear fuel will start to operate at Rotondella, with a consequent release of radioactive wastes in the Jonian Sea. A fresh water environment was also considered, the Lago Santo Parmense. The radioactivity measured in the various substrata (sediment, water, vegetables) is by far higher than the one of the marine environment. In particular the $^{137}$Cs contribution to the sediment radioactivity is remarkable. (auth)

## Atmosphere

*Refer also to abstract 626.*

**380** (ARMS-70.6.9) ARMS: AERIAL RADIOLOGICAL MEASURING SURVEY OF THE AREA SURROUNDING THE POINT BEACH NUCLEAR PLANT, TWO CREEKS, WISCONSIN, AUGUST 16 AND 17, 1970. (EG and G, Inc., Las Vegas, Nev. (USA)). Oct 1973. 16p. Dep. NTIS $4.00.

The Aerial Radiological Measuring System (ARMS) was used to survey the area surrounding the Point Beach Nuclear Plant during August 1970. The survey measured terrestrial gamma radiation. A high-sensitivity detection system collected gamma spectral and gross-count data. The data were then computer processed into a map of a 312 square mile area showing isoexposure contours three feet above the ground. Exposure rates and isotopes identified are consistent with normal terrestrial background. (auth)

**381** (BNWL-SA-4723) PARTICULATE AND GASEOUS ATMOSPHERIC IODINE CONCENTRATIONS. Brauer, F. P.; Rieck, H. G. Jr.; Hooper, R. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 24 Aug 1973. 20p. (CONF-731110-1; SM-181/6). Dep. NTIS $3.00.

From symposium on the physical behavior of radioactive containment in the atmosphere; Vienna, Austria (12 Nov 1973).

Large-volume air sampling equipment was used to collect routine particulate and gaseous iodine samples. Filter paper and activated charcoal beds were used to collect particulate and gaseous iodine fractions, respectively, from the atmosphere. Samples were collected for two-week periods over several years at Barrow, Alaska; Great Falls, Montana; Rio de Janeiro, Brazil and at several locations in the state of Washington. The samples were analyzed by gamma spectrometry for gamma-emitting radionuclides. Beta-gamma coincidence spectrometry was used for low-level $^{131}$I analyses. Neutron activation analysis was used to measure the natural iodine ($^{127}$I) and $^{129}$I content of the samples. Results of these measurements are summarized. Seasonal variations were noted in the observed isotopic concentrations. The ratio of particulate to gaseous iodine was observed to vary with time and isotope. The significance of the data in the formulation of atmospheric dispersion models and prediction of environmental impacts is discussed. (auth)

**382** (EGG-1183-1591) RADIOLOGICAL SURVEY OF THE AREA SURROUNDING THE ELK RIVER REACTOR, ELK RIVER, MINNESOTA. Date of Survey: 1, 2 August, 24 September 1968. Technical Report No. L-1105. (EG and G, Inc., Las Vegas, Nev. (USA)). 1 May 1973. Contract AT(29-1)-1183. 21p. Dep. NTIS $3.25.

The Aerial Radiological Measuring System (ARMS) was used to survey the area surrounding the Elk River experimental power reactor during Aug. and Sept. 1968. The survey measured terrestrial gamma radiation. A high-sensitivity detection system collected gamma spectral and gross-count data. The data were then computer processed into a map of a 900 square mile area showing isoexposure contours three feet above the ground. Exposure rates and isotopes identified are consistent with normal terrestrial background radiation. (auth)

**383** (IITRI-C-6105-23) SCAVENGING STUDY OF SNOW AND ICE CRYSTALS. Final Technical Report for the Period 1 April 1972–31 March 1973. Knutson, E. O. (IIT Research Inst., Chicago, Ill.). Apr 1973. Contract AT(11-1)-578. 99p. Dep. NTIS $7.00.

Electrostatic effects in the scavenging of aerosol particles by falling snow and ice crystals were studied in an outdoor experiment. Natural snow and ice crystals were allowed to fall 157.5 cm through a test chamber containing an anthracene aerosol of measured size and concentration. The electrostatic charge of each flake was measured upon chamber entry by an induction-type charge sensor. Flakes were retrieved individually from the chamber bottom and photographed to document size and shape. The melted residue from each flake was examined by ultraviolet microscopy to determine the number of anthracene particles caught. The anthracene aerosol was generated by condensation of vapor upon NaCl nuclei. The mean diameter was 0.80 μm and the standard deviation was 0.16 μm. The particles had the Boltzmann equilibrium charge distribution. In some tests, the aerosol was passed through an electric mobility analyzer to select singly charged 0.70 to 0.94 μm diameter particles. The aerosol concentration was determined frequently by sampling with an impactor or an electrostatic sampler, and counting the deposit with a microscope. The concentration range was from 300 $cc^{-1}$ to 5000 $cc^{-1}$. Fifty-five flakes were collected and analyzed during the 1972-73 winter season. The electrostatic charges on the flakes ranged from −3.5 to $+1.7 \times 10^{-4}$ statcoulomb, and 49 of the flakes were negatively charged. The flake projected areas, as measured from the photographs with an image analyzing computer, ranged from 0.13 to 2.7 $mm^2$. The number of anthracene particles caught was 0 to 22. The scavenging efficiencies computed for the individual flakes range from unmeasurable (< .005%) to about 5%. No correlation with the three Kramer-Johnstone parameters that characterize electrostatic scavenging could be found. All previous project data on snowflake scavenging were pooled in order to develop an empirical model for snow scavenging. The most satisfactory representation of scavenging is the following equation: $\ln(N_c/C \cdot Z) = -7.302 + 0.8111 \ln D_c - 0.0410\ T + 3.412 \ln D_p - 0.423 (\ln D_p)^2 - 1.358 (\ln D_p)^3$ where $N_c$ is the particle catch, C is the aerosol concentration, Z is the distance the snowflake falls through the aerosol, T is the temperature, $D_p$ is the particle size, and $D_c$ is the flake size. (auth)

**384** (IITRI-C–6105-24) SCAVENGING STUDY OF SNOW AND ICE CRYSTALS. Quarterly Report, 1 April 1973–30 June 1973. Knutson, E. O. (IIT Research Inst., Chicago, Ill. (USA)). 6 Jul 1973. Contract AT(11-1)-578. 32p. Dep. NTIS $3.75.

The pooled data from four years of experiments on aerosol scavenging by individual snow and ice crystals and by snow flakes were analyzed in terms of dimensionless variables. This work compliments an earlier analysis in terms of the primitive variables. The present analysis consists of plots and regressions of log E vs. log I, log (Stk) and log (Pe), as well as log (EIPe) vs. log $(IPE^{1/3})$ and log $(IPe^{1/3})$. The symbols are: E, scavenging efficiency; I, interception parameter; Stk, Stokes number; and, Pe, Peclet number. The various plots and regressions indicate that interception is the primary mechanism of scavenging. The plot of log E vs. log I yields a band of data lying just above the line E = 3I, which is the theoretical line for interception scavenging by spheres in potential flow. The regression line for the data is: $\log_{10} E = 2.477 + 1.366 \log_{10} I$. The standard deviation of the residuals is 0.538. Useful presentations of the data are also achieved by using the "Friedlander coordinates", EIPe vs. $IPe^{1/3}$ and EIPe vs. $IPE^{1/3}$. These dimensionless groups are appropriate for scavenging due to the simultaneous action of diffusion and interception. The first pair pertains to Stokes (i.e. low speed) flow, while the second pertains to potential flow. Fortuitously, the approximate expression for interception-diffusion scavenging by spheres in potential flow fits the snow scavenging data. (auth)

**385** (LA-UR-73-954) MATHEMATICAL MODEL FOR THE TRANSPORT OF ENVIRONMENTAL PLUTONIUM. Travis, J. R. (Los Alamos Scientific Lab., N. Mex. (USA)). [nd]. Contract W-7405-eng-36. 7p. (CONF-731101-16). Dep. NTIS $3.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum and Nuclear Energy Exhibition; San Francisco, California, USA (11 Nov 1973).

A mathematical model describing the behavior of particulate Pu in the lower atmosphere is proposed which accounts for particles settling or impinging on the earth's surface as well as particle re-entrainment or resuspension. The assumptions used and system of equations derived are discussed. (LCL)

**386** (PRNC-171) METHOD TO DETERMINE GASEOUS EFFLUENTS FROM THE PUERTO RICO NUCLEAR CENTER TRIGA FLIP REACTOR. Rivera, E.; Paraskevoudakis, P. (Puerto Rico Nuclear Center, Mayaguez). Apr 1973. Contract AT(40-1)-1833. 47p. Dep. NTIS $4.50.

Thesis. Submitted by E. Rivera to Puerto Rico Univ., Mayaguez.

To determine the $^{41}A$ concentration in gases in the TRIGA-FLIP reactor building, a fast and simple method was developed. The method uses the technique of grab sampling. Spherical glass containers were utilized as sample collectors and were counted with a NaI crystal. It was found that the instrument total efficiency curve determined from point sources can be effectively applied to the glass spheres of much larger volume. The measured values of $^{41}A$ concentration in the air of the reactor building were well below the limits specified in the existing AEC regulations. The Kanne chamber, which is the constant air monitor of the reactor system, was accurately calibrated. The calibration was performed utilizing the same $^{41}A$ produced in the reactor core that emerged through the pool water on the surface. Its concentration was accurately determined in order to use it as a calibrated source in the Kanne chamber for calibration. (auth)

**387** (UCRL-51440) PROBLEMS WITH PREDICTING FALLOUT RADIATION HAZARD IN TACTICAL BATTLEFIELD SITUATIONS. Schiff, A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 Aug 1973. Contract W-7405-eng-48. 32p. Dep. NTIS $4.00.

Prediction capabilities are reviewed to determine whether they are suitable for describing the fallout radiation hazards that may exist in tactical nuclear battlefield situations. One aspect of fallout predictability is illustrated by a collection of aberrant results from nuclear tests conducted under fairly stabilized conditions. There are a number of warnings about the confidence that should be placed on prediction schemes derived from nuclear test shots. A comparison of current fallout models shows uncertainties including wind, terrain, rainout, and cloud parameters. Some consequences of depending on faulty predictions are serious. The search for the best-of-all-possible prediction schemes will not lead to fruitful results because of the complexities involved. A set of limits to the upper and lower bounds to expected fallout should be adopted as a practical means of using prediction schemes for tactical warfare. It is emphasized that there is no substitute for hard data and that a computerized radiation data collection, reduction, and display system should be contemplated to satisfy the need to respond to fallout problems on the battlefield. (auth)

**388** (WASH-1217-73) CHEMIST–METEOROLOGIST WORKSHOP, FT. LAUDERDALE, FLORIDA, JANUARY 15–19, 1973. (USAEC Division of Biomedical and Environmental Research, Washington, D. C.; Environmental Protection Agency, Research Triangle Park, N. C. (USA)). 1973. 48p. (CONF-730128-(Absts.)). GPO $0.45.

Panel recommendations from the Third Chemist–Meteorologist Workshop are presented with the hope that these recommendations will be useful in determining air pollution problems needing further research and in establishing priorities for programming and funding such research studies. The recommendations were made by four separate panels on: regional air studies, disposition and removal processes; global balances of chemical pollutants and radioactive gases; and photochemical and transformation modelling of pollutants. (LCL)

**389** CONTROLLING EMPLOYEE EXPOSURE TO ALPHA RADIATION IN UNDERGROUND URANIUM MINES. Volume 1. Rock, R. L.; Walker, D. K. Washington, DC; Bureau of Mines (1970). 76p. GPO $0.40.

A general discussion is presented of the radon-daughter hazard associated with underground uranium mining and the control measures which are effective in eliminating this danger. The problem of employee exposure to radiation in underground uranium mines is reviewed, methods of determining atmospheric α radiation levels are discussed, and practical methods of reducing radon and radon daughter influx into active mine openings are presented. Other pertinent subjects in radiation control are discussed such as mine ventilation, mine planning, miner education, and individual exposure protection. (auth)

**390** DYNAMIC CONTENT OF RADIOACTIVE EMANATIONS IN THE ATMOSPHERE OF MINES. Kartashov, N. P.; Shumkov, G. F. At. Energ. (USSR); 35: No. 3, 155-158(Sep 1973). (In Russian).

Concentration calculations of natural radioactive emanations in the atmosphere of mines for various regimes of ventilation are presented. It has been shown, in particular, that in excavations with an air-exchange multiplicity $>1 \cdot 10^{-2}\ s^{-1}$, for equal contents of uranium and thorium in the ore, the average concentration of thoron may be several times greater than the concentration of radon for a volume of excavated ore. (2 figures, 1 table, 8 references.) (auth)

**391** NUCLEAR WEAPON TESTS, 1945-1972. Hvinden, T. (Forsvarets Forskningsinstitutt, Kjeller, Norway). Sivilt Beredskap; 16: No. 2, 14-19(1973).

General information on the background for nuclear weapon tests is given. Tables and diagrams show the distribution of tests chronologically and by nationality. General remarks on radioactive fallout are accompanied by a diagram showing the level of radioactive fallout at Kjeller, Norway, from 1956 to 1972. A short survey of underground tests, military and civil, is given, and international agreements and discussions are commented on. (NO)

## Soil

*Refer also to abstract 2330.*

**392** RADIATION DOSES FROM RADIOACTIVITY DEPOSITED ON THE GROUND. Bassi, C. Securitas; 57: No. 4, 321-363(1972). (In Italian).

The external dose of radioactivity due to the deposition on the ground of a known quantity of radioactive material was theoretically calculated. The results were analyzed on the basis of some experimental data obtained by assuming that such deposition was due to material washed away by rain from the atmosphere. The agreement was found satisfactory: the increase of the natural external dose-rate did not exceed 5.5 μR/hr on a background of 12 μR/h. The equipment and the methods used are fully described. (INIS)

**393** NOTE ON THE α-RADIOACTIVITY OF SEVERAL POLISH MAGMATIC ROCKS. Rymaszewska, M.; Duszynska, M. (Univ. of Warsaw). Przegl. Geofiz.; 16: 327-329(1971). (In Polish).

The α and β radioactivity of several magmatic rocks from Karpaty and Sudety was investigated. The results of measurements were compared with other publications on radioactivity of rocks. The comparison allows certain conclusions to be drawn about the method using the Evans equation. (auth)

## Water

*Refer also to abstract 118.*

**394** (COO-3563-14) FALLOUT RADIONUCLIDES IN OCEANIC WATER COLUMNS. Semi-Annual Progress Report to GEOSECS. Volchok, H. L.; Bowen, V. T. (USAEC Health and Safety Lab., New York; Woods Hole Oceanographic Institution, Mass. (USA)). 1973. 23p. Dep. NTIS $3.25.

Tabulated data are presented for measurements of the temperature distribution, salinity, and content of $^{137}$Cs, $^{239}$Pu, and $^{90}$Sr at varying depth in water columns in the North Atlantic Ocean, Greenland Sea, and Norwegian Sea. The data were measured at 12 locations during the period from 28 July to 27 Sept. 1972. The results are discussed. (LCL)

**395** (COO-3563-16) GENERAL SUMMARY OF PROGRESS, 1972-1973. Bowen, V. T. (Woods Hole Oceanographic Institution, Mass. (USA)). 1973. Contract AT(11-1)-3563. 35p. Dep. NTIS $3.75.

Reports on marine radioactivity studies that have been submitted, accepted, or published in the scientific literature are listed. Research progress is reported briefly under the following headings: quality control data in radiochemistry and interlaboratory comparisons; vertical penetration of fallout in Atlantic Ocean water columns; effect of changing rates of fallout delivery on the mean North Atlantic surface concentration of $^{90}$Sr; and inventory data from integrating profiles of $^{90}$Sr concentration at North Atlantic stations from 1972. (DHM)

**396** (ORO-4328-1) ECOLOGICAL EFFECTS OF NUCLEAR STEAM ELECTRIC STATION OPERATIONS ON ESTUARINE SYSTEMS. Volume I. Second Progress Report. Mihursky, J. A. (Maryland Univ., Solomons. Natural Resources Inst.). Aug 1973. Contract AT(40-1)-4328. 193p. Dep. NTIS $11.75.

Separate abstracts were prepared for each of the seven chapters presented in volume 1 of this report. (ERB)

*For abstracts of individual chapters see: 360, 397, and 430–434.*

**397** (ORO-4328-1, pp 9-15) GAMMA-EMITTING RADIONUCLIDES IN CHESAPEAKE BAY SEDIMENTS NEAR CALVERT CLIFFS. Cressy, P. J. Jr. (Goddard Space Flight Center, Greenbelt, MD). Aug 1973.

Ecological effects of nuclear steam electric station operations on estuarine systems. Volume I.

The purpose of this study is several-fold: to determine present base levels of gamma-emitting radioactive species in sediments that may be affected by the operation of the Calvert Cliffs Nuclear Power Plant; to measure the distributions of these radionuclides as sorbed and mineralic (K, U, and Th) species among various sediment materials (i.e., quartz sand, clay, organic matter, minor mineral components); to study variations in concentrations with time (including the effect of resuspension or deposition of sediment by storm activity) and with other measurable parameters of the Bay, such as pH, temperature, salinity; and to investigate the uptake of existing radionuclides by vegetative and animal species in the Bay. Preliminary studies utilized sediment samples obtained from the surface (to about 10 cm) of the Bay floor on a quarterly basis by anchor dredge, under the direction of personnel from the Hallowing Point Field Station. The locations of these sampling sites are described. Data are included from samples obtained on 5/16–17/72 and 8/8/72, before and after tropical storm Agnes. (auth)

**398** INFLUENCE OF SOME FACTORS ON THE RADIOACTIVITY OF BOTTOM SEDIMENTATION IN A LIMNIC RESERVOIR. Kwapulinski, J. (Instytut Gospodarki Komunalnej, Warsaw). Nukleonika; 18: No. 5, 219-228(1973). (In Polish).

An investigation of the β-radioactivity of a bottom sedimentation at a given granulation is reported that considers the degree agitation of the water in the reservoir at given period; the species of bottom sedimentation; the part percentage of the given fraction in the species; the distance from the barrage. The higher β-radioactivity was observed when the shallow reservoir was unagitated. The relative β-radioactivity can be calculated from the formula: $A = 4.14 \cdot e^{2 \cdot 13 \cdot 10^{-4}} \cdot S$ pCi/g. (auth)

**399** INFLUENCE OF THE PHYSICO-CHEMICAL FORMS OF RADIONUCLIDES AND STABLE TRACE ELEMENTS IN SEAWATER IN RELATION TO UPTAKE BY THE MARINE BIOSPHERE. Robertson, D. E. (Battelle-Northwest Labs., Richland, WA). pp 21-93 of Marine Radioecology. Paris; Organization for Economic Co-operation and Development (1972).

From marine radioecology symposium; Hamburg, F. R. Germany (20 Sep 1971). See CONF-710988-.

Atmospheric fallout enters the ocean as a very finely divided aerosol, whereas discharges from reactors and nuclear fuel reprocessing plants may be in the form of primary or secondary cooling waters, treated low level wastes, or accidental releases from ruptured fuel elements. The physico-chemical forms of the artificial radionuclides entering the oceans from these various sources are diverse, and generalizations concerning their behavior and fate in the marine environment are not applicable for all marine regimes. The possible physico-chemical forms that may occur in the ocean are: species in true solution; colloidal species; and particulate forms. Case studies of the influence of physico-chemical forms of radionuclides in relation to biological uptake are presented for $^{55}$Fe, $^{65}$Zn, $^{106}$Ru, and $^{239}$Pu. (ERB)

## Ecosystems and Food Cycles

*Refer also to abstracts 664, 782, 799, 805–807, 809–811, 827, and 834–837.*

**400** (BLG-477(Vol.1)) STUDY OF THE BIOLOGICAL CYCLE OF RADIOACTIVE NUCLEI. Volume 1. Kirchmann, R.; Lafontaine, A.; Cantillon, G.; Boulenger, R. (Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium)). Feb 1973. 42p. (In French). Dep. NTIS (U.S. Sales Only) $4.25.

The study, which lasted from 1961 to 1967, is published in two volumes. This volume specifies the problem arising from the contamination of the environment by $^{226}$Ra from industrial effluents. The genesis, the development of the program, as well as the conclusions on the scientific, health, practical and executive level are described. (auth)

**401** (BLG-477(Vol.2)) STUDY OF THE BIOLOGICAL CYCLE OF RADIOACTIVE NUCLEI. Volume 2. Technical Part. Kirchmann, R.; Lafontaine, A.; Cantillon, G.; Boulenger, R. (Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium)). Feb 1973. 125p. (In French). Dep. NTIS (U.S. Sales Only) $8.25.

The different stages of the program are described and included are the results obtained in each segment studied: radiologic surveys, physico-chemical studies of the dispersion of $^{226}$Ra, flora, fauna, agricultural studies, and human investigations. Techniques for measuring samples are described in detail. (auth)

**402** (COO-2122-12) FALLOUT STRONTIUM-90 AND CESIUM-137 IN NORTHERN ALASKAN ECOSYSTEMS DURING 1959–1970. Hanson, W. C. (Colorado State Univ., Fort Collins. Dept. of Radiology and Radiation Biology). May 1973. Contract AT(11-1)-2122. 259p. Dep. NTIS $15.00.

Thesis.

Cycling routes, rates of transport, and resultant concentrations of the fallout radionuclides $^{90}$Sr and $^{137}$Cs in northern Alaskan ecosystems were defined during the period 1959 to 1970. Radiochemical analysis of extensive samples of biota and whole-body counting of $^{137}$Cs in Eskimo and Indian ethnic groups were related to ecological principles, especially the concept of trophic niche, which elucidated the observed patterns of radionuclide concentrations. Experiments involving Sr and Cs radioisotopes applied to natural Cladonia–Cetraria lichen carpets yielded effective half-times of 1.0 to 1.6 years for Sr and more than 10 years for Cs. Direct and indirect estimates of $^{137}$Cs half-times in Eskimos on a caribou meat diet were made by dietary manipulation and by relating dietary $^{137}$Cs intake and resultant change between periodic whole body counts. Effective half-times of 70 days for adults (more than 21 years old) and minors (14 to 20 years old) and of 45 days for children (less than 14 years old) were found. Suitable mathematical models were used to compute lichen forage ingestion rates of free-ranging adult caribou (4.5 to 5.0 kg dry weight per day), caribou meat ingestion rates of Anaktuvuk Pass residents (up to 2 kg wet weight per day for men), and $^{90}$Sr body burdens of Anaktuvuk Pass residents during the period 1952 to 1968 (maximum value of 8 nCi in adult males during late 1966 to early 1967). Special emphasis was made of cultural influences upon the food-gathering patterns of the native peoples studied. Culture change, especially in the form of food stamps, welfare payments, acquisition of snowmobiles, and improved housing was documented throughout the study and noticeably reduced the radionuclide accumulations. Total radiation dose rates to the Anaktuvuk Pass adult population were estimated to be about 100 mrad/year from natural sources, 60 to 140 mrad/year from $^{137}$Cs body burdens, and 20 to 130 mrad/year from $^{90}$Sr body burdens. (CH)

**403** (LURI–1972-9) $^{155}$Eu, $^{144}$Ce, $^{125}$Sb, $^{106}$Ru, $^{95}$Zr, $^{54}$Mn, AND $^{7}$Be IN THE REINDEER LICHEN CLADONIA ALPESTRIS: DEPOSITION, RETENTION AND INTERNAL DISTRIBUTION, 1961–1970. Mattsson, L. J. S. (Lund Univ. (Sweden). Radiofysiska Institutionen). Sep 1972. 50p. Dep. NTIS (U. S. Sales Only) $4.50.

The retention and distribution of the fallout radionuclides $^{155}$Eu, $^{144}$Ce, $^{137}$Cs, $^{125}$Sb, $^{106}$Ru, $^{95}$Zr, and $^{54}$Mn and the naturally occurring radionuclide $^{7}$Be were studied in undisturbed natural carpets of the lichen Cladonia alpestris, a major component of the diet of reindeer in the Lake Rogen district in central Sweden during the period 1961 to 1970. The contents of the artificially produced radionuclides in the lichen-carpet reached their maxima in 1963 to 1966 and all showed high retention values. During the seven-year period of 1962 to 1968 the average absorbed dose in the gut of a reindeer was calculated to be about 3 rad due to the passage of the food alone. The dominating contributions (about 40%) came from $^{144}$Ce. (CH)

**404** (NERC-LV-539-2(Suppl.)) SUPPLEMENT TO THE OFF SITE RADIOLOGICAL SAFETY REPORT FOR THE CANNIKIN EVENT, NOVEMBER 6, 1971. (National Environmental Research Center, Las Vegas, Nev. (USA)). Aug 1973. Contract AT(26-1)-539. 5p. Dep. NTIS $4.00.

Samples of salmon, shrimp, and crab were collected from commercial fishing areas in November, 1972, and analyzed for $^{89}$Sr, $^{90}$Sr, $^{3}$H, and K. The tabulated results show that the concentrations were essentially the same as those in 1971. (HLW)

**405** MARINE RADIOECOLOGY. The Cycling of Artificial Radionuclides Through Marine Food Chains. Conference Held at Hamburg, Germany, September 20–24, 1971. Paris; Organization for Economic Co-operation and Development (1972). 214p. (In French and English). (CONF-710988-). $4.50.

Separate abstracts were prepared for each of the three papers presented in these proceedings. (ERB)

*For abstracts of individual papers see: 399 and 827.*

**406** CHEMICAL AND RADIONUCLIDE FOOD CONTAMINATION. New York; MSS Information Corporation (1973). 190p.

Separate abstracts were prepared for 14 chapters. Eight additional chapters discuss potential carcinogens in food and the contamination of foods by pesticides. (CH)

*For abstracts of individual chapters see: 407–409, 805–811, and 834–837.*

**407** PREDICTION MODELS FOR STRONTIUM-90 AND CESIUM-137 LEVELS IN THE HUMAN FOOD CHAIN. Aarkrog, A. pp 77-107 of Chemical and Radionuclide Food Contamination. New York; MSS Information Corp. (1973).

Mathematical models for the prediction of fallout $^{137}$Cs and $^{90}$Sr levels in human food chains were evaluated on the basis of measurements of fallout deposition on vegetation, in air samples, in samples of precipitation, and in samples of the total diet, milk, cereals, potatoes and other vegetables, in meat (beef, pork, and seafood), and in samples of adult and infant bones collected during a five-year period (1962 to 1967). During this time the predominant source of long-lived fission products in the environment was the 1961 and 1962 weapons test series. For the total diet and for the most important components in the food chain it was possible to predict the $^{90}$Sr and $^{137}$Cs levels mathematically on the basis of fallout rate and accumulated deposit as independent variables. The $^{137}$Cs and $^{90}$Sr levels in human tissues and whole-body counting data followed equations similar to those calculated for the diet. Estimates of the soil factors in the equations used received special attention. It was concluded that the soil factors for $^{90}$Sr were reliable but that more reliable determinations are needed for soil factors for $^{137}$Cs to determine the long-term fate of $^{137}$Cs in the human food chain. (CH)

**408** RELATION BETWEEN THE DEPOSITION OF LONG LIVED FISSION PRODUCTS AND THE TOTAL DIETARY INGESTION. Strackee, L.; Mattern, F. C. M. pp 173-180 of Chemical and Radionuclide Food Contamination. New York; MSS Information Corp. (1973).

Methods used for the prediction of levels of $^{137}$Cs and $^{90}$Sr in the human diet from data on the content in air or precipitation are discussed. The possibility of delay between contamination of foodstuffs and their uptake by man is considered, with the fact that during winter months cattle are fed on stored food, which would affect the migration rate of radionuclides through milk or meat food chains. Results are reported from a systematic survey of the contents of $^{137}$Cs and $^{90}$Sr in 10 different categories of foodstuffs during 1962 to 1968, and data on the percentage contributions of $^{137}$Cs and $^{90}$Sr in milk and milk products were derived. It was concluded that estimates of $^{137}$Cs and $^{90}$Sr in the diet should be based on quarterly measurements of the content of representative foodstuffs. (CH)

**409** RADIOACTIVITY IN THE DIET OF POPULATION OF THE KERALA COAST INCLUDING MONAZITE BEARING HIGH RADIATION AREAS. Mistry, K. B.; Bharathan, K. G.; Gopal-Ayengar, A. R. pp 181-188 of Chemical and Radionuclide Food Contamination. New York; MSS Information Corp. (1973).

Data are presented on the gross $\alpha$, gross $\beta$, 85 keV $\gamma$, $^{228}$Ra, and $^{40}$K content in representative foodstuffs consumed by the human population of the monazite high background radiation areas along the Kerala coast of India. The data were used in conjunction with a dietary survey of selected families to estimate the daily dietary intake of radioactivity by the population. (CH)

**410** UTILIZATION OF SIMPLE MODELS IN RADIOECOLOGY. Bernhard, M. (CNEN, La Spezia, Italy). pp 129-163 of Marine Radioecology. Paris; Organization for Economic Cooperation and Development (1972).

From marine radioecology symposium; Hamburg, F. R. Germany (20 Sep 1971). See CONF-710988-.

The application of the compartment theory to a two- and a three-compartment system is shown. All differential equations are solved numerically. Solutions are presented for a two-compartment closed system not in steady-state and a closed three-compartment system not in steady-state. Examples are provided for both systems. (ERB)

**411** TRACE ELEMENT DISTRIBUTIONS IN LAKE MICHIGAN FISH: A BASELINE STUDY WITH CALCULATIONS OF CONCENTRATION FACTORS AND EQUILIBRIUM RADIOISOTOPE DISTRIBUTIONS. Copeland, R. A.; Beethe, R. H.; Prater, W. W. ERG Special Report No. 2. Ann Arbor, MI; Environmental Research Group, Inc. (1973). 143p. $6.00.

Two hundred fish from Lake Michigan consisting of eighteen different species were analyzed for 37 elements of radiological and toxicological significance by neutron activation analysis. The results of this study create a baseline level for trace elements in Lake Michigan fish and indicate, in general, that the trace element chemistry of Lake Michigan fish is similar to that of fresh water fish throughout the world. The major finding, from a radiological standpoint, was that no isotope would build-up in fish to a level greater than 45% of the permissible level even assuming the worst conditions. These worst conditions being a fish living in a canal type discharge system which contains the maximum allowable concentration of radioactive isotopes. The edible portions of most fish living in the immediate vicinity of a canal type discharge would not exceed 5% of the permissible level for any isotope. Fish data indicates that there is no stepwise buildup of trace elements as one moves up the food chain. That is, the concentration factors for fish are similar to plankton and benthos. Arsenic was found to vary widely from species to species and within species by geographical distribution. Arsenic in yellow perch was consistently found to be much lower than the other fish studied. Mercury was below 0.5 ppM for all except five fish. Results indicate slightly higher mercury levels in fish caught in the northern half of Lake Michigan. Trace element data for each species of fish are tabulated. Equilibrium radioisotope concentrations for fish living in likely maximum effluent concentrations are also tabulated. (HLW)

**412** RADIOACTIVITY OF MATERIALS OF VETERINARY INTEREST. Zotov, V. G. (Uzbek Republic Veterinary Lab., Tashkent). Veterinariya; 10: 31-32(Oct 1971). (In Russian).

Analyses of fodder, milk, meat, and bone carried out in the Uzbek Republic in 1966-67 showed that 62% of the beta activity present in green fodder and 94% of that in meat are due to $^{40}$K. Other products fall between these two values. To $^{90}$Sr = $^{90}$Y are due 1% of the beta activity in cottonseed meal, 0.6% in meat, 1.4% in milk, and 82% in bone. The radionuclide $^{137}$Cs is responsible for lower percentages of the beta activity. These and other data indicate that the beta activity in Uzbek products of veterinary interest is due chiefly to natural radioactive products. (TTT)

## Radiometric Techniques

**413** POLLEN ANALYSIS AND RADIOCARBON DATING OF A PEAT ON SLIEVE GALLION, CO., N. IRELAND. Pilcher, J. R. (Queen's Univ., Belfast). New Phytol.; 72: No. 3, 681-689(May 1973).

A radiocarbon dated pollen diagram is presented from 430 m altitude on Slieve Gallion, Co. Tyrone, N. Ireland. Deposits of reedswamp peat overlain by blanket peat cover the period from about 8000 B.C. to the present. Total tree pollen remains mostly below 60% of total pollen throughout the Post-glacial indicating more open conditions than are found in the lowlands. Lack of herb pollen suggests areas of bare rock on the mountain top before about 7650 B.C. (auth)

**414** ANOMALOUS FADING OF THERMOLUMINESCENCE IN MINERAL SAMPLES. Wintle, A. G. (Oxford Univ.). Nature (London); 245: No. 5421, 143-144(21 Sep 1973).

It is stated that in attempts to date volcanic lava from geologically recent flows (5,000 to 50,000 yr) by measuring the thermoluminescence (TL) from the feldspars present, the results were always significantly lower than the accepted ages of the lava flows. The reason for this discrepancy is a loss of charge carriers from traps that contribute to the TL in the 350° to 450° region of the glow curve, causing "anomalous fading" that has been directly demonstrated in the laboratory for a variety of feldspars. Details of the experimental work are given, and glow curves are shown for a basalt lava sample from the Massif Central region, showing a 45% TL loss at the 400°C ordinate after storage for 3 days at room temperature. The behaviour of other lava samples followed this pattern. Quartz showed no loss above the 250°C glow curve ordinate; and the profile of the curve was that expected from thermal emptying of the shallower traps only. Various feldspar separates, limestones, fluorapatite, and zircon were also examined, and results are tabulated. It is pointed out that failure to observe fading in a short term experiment does not exclude longer term fading. Fading rate appears to be independent of the type of irradiation unless this is $\alpha$-irradiation; the latter produces greater fading. The mechanism for fading is being investigated. (UK)

**415** SWELLING AND SHRINKING OF SOIL IN SITU AS DETERMINED BY A DUAL ENERGY GAMMA-RAY TRANSMISSION TECHNIQUE. Reginato, R. J. Riverside, CA; Univ. of California (1973). 80p. University Microfilms Order No. 73-23,837.

Thesis (Ph. D.).

The magnitude, rate, and depth of swelling and shrinking of soil in situ must be known to make valid use of gravimetric soil-water measurements for assessing water movement caused by evaporation and/or transpiration. Bulk density changes of 1-cm depth increments in the surface 10-cm of a soil pedon were used to characterize the swell-shrink properties of the subject soil. These changes were measured with a dual energy gamma transmission technique. Results of this study have demonstrated that the two gamma sources cannot be used simultaneously but rather separately, when the sources and detector are not collimated. The separation of sources was necessary because the backscattered $^{137}$Cs photons could not be separated from the lower energy unattenuated $^{241}$Am photons in the soil-water system. In the field, density changes were very rapid, dropping from 1.33 to 0.75 g cm$^{-3}$ in the 1- to 2-cm layer about 30 minutes after water was applied to the soil surface. The soil surface elevation, monitored with a linear variable differential transformer transducer, also showed a rapid change in height after the water addition (+0.6 mm 10 minutes after the third irrigation). Shortly after the water disappeared from the soil surface, the bulk densities returned to nearly the pre-irrigation values for the various 1-cm thick soil layers. Swelling and shrinking occurred to a depth of 4 to 6 cm even after four irrigations. Repeated irrigations (wet-dry cycles) decreased the magnitude of density changes, but the changes still occurred as rapidly and as deeply as they had in earlier irrigations. These findings support the common practice of using a measured bulk density profile to convert gravimetrically determined soil-water contents to a volumetric basis. The results also demonstrate that a single energy gamma source can be used to monitor water content changes in the upper part of the soil pedon once irrigation water has subsided. (Diss. Abstr. Int., B)

**416** APPLICATION OF GAMMA SPECTROMETRY IN THE KOLA PENINSULA. Golovin, I. V.; Kolesnik, N. I.; Antipov, V. S. Razved. Okhr. Nedr; No. 3, 43-48(1973). (In Russian).

The methodology used and results obtained in gamma spectrometric studies of pre-Cambrian formations of some nickel-bearing regions of the Kola Peninsula are described. The radioactive element contents of typical metamorphic and magmatic complexes and sulfide ores are presented. (au-trans)

**417** USE OF SINGLY SCATTERED GAMMA RADIATION FOR DETERMINING ORE BODIES. Gera, D. F.; Moroz, N. I.; Shastova, L. S.; Kraznoperov, V. A. Razved. Okhr. Nedr; No. 1, 33-37(1973). (In Russian).

Results are presented of tests on the GGK-OR method which uses the recording of a single low-energy gamma irradiation of rare metal and gold ore deposits to determine the precise location of geological sections. (tr-auth)

**418** ATMOSPHERIC RADIOACTIVITY MEASUREMENTS CARRIED OUT IN THE CAMPIDANO PLANE FOR THE STUDY OF TURBULENCE ON THE GROUND. Dalu, G. (Consiglio Nazionale delle Ricerche, Rome); Sanna, S. Riv. Meteorol. Aeronaut.; 32: No. 4, 349-357(1972). (In Italian).

A method to obtain the turbulent diffusion coefficient in the earth atmosphere by measuring the radon concentration at two different heights is proposed. Measurements were made at Campidano, Sardinia, Italy with two different methods: the first one gives the direct measurement of the radon concentration, while the second one gives the radon and the thoron concentrations by measuring the activity of their decay products. The measurements were correlated to the meteorological conditions found in that period. The data showed the possibility of formation of radon accummulation layers, and therefore an increase of the vertical mixing can carry radon towards the ground. (INIS)

**419** RADIORESPIROMETRIC MEASUREMENT OF METABOLIC ACTIVITIES IN SOIL. Hubbard, J. S. pp 199-206 of Modern Methods in the Study of Microbial Ecology. Rosswall, T. (ed.). Stockholm; NFR, Editorial Services (1973).

From conference on modern methods in the study of microbial ecology; Uppsala, Sweden (19 Jun 1972).

Radiorespirometric methods for measurement of metabolic activities in soils are described for two areas: measurement of $^{14}CO_2$ assimilation and evolution of $^{14}CO_2$ during catabolism of $^{14}$C-substrates. The experiment consists of measurement of the amount of $^{14}$C that is assimilated after aliquots of moistened soils are incubated in an atmosphere enriched with $^{14}CO_2$. The second method involves the quantitation of $^{14}CO_2$ evolution after providing the samples with $^{14}$C-labeled substrates. (SW)

## Site Surveys

*Refer also to abstracts 371–373, 379, 380, 404, and 2298.*

**420** (AEC-tr-7476) USE OF RADIOECOLOGY IN SELECTION OR STUDY OF ELECTRONUCLEAR AND INDUSTRIAL SITES. 1973. Translation of Role de la Radioecologie Dans le Choix ou l'Etude des Sites Electronucleaires et Industriels. 7p. Dep. NTIS $3.00.

At a time when energy requirements urgently necessitate the establishment of new nuclear power plants to augment present electric-power generating capacity, it is manifestly no longer possible to ignore the inevitable impact of such facilities upon the environment. Experience gained over the past 20 years in the study of nuclear sites augurs well for the fruitful cooperation between ecological research and agencies responsible for French territorial development. The permanent concern for maintaining the biosphere's balance and for safeguarding human health, can only result in joint action to counter the various forms of industrial, agricultural, and urban pollution. (auth)

**421** (LA-5362-MS) REGIONAL GEOLOGY AND GEOPHYSICS OF THE JEMEZ MOUNTAINS. West, F. G. (Los Alamos Scientific Lab., N. Mex.). Aug 1973. Contract W-7405-eng-36. 7p. Dep. NTIS $4.00.

The western margin of the Rocky Mountain tectonic belt is the initial site for the Los Alamos Geothermal Project. Igneous activity in the area culminated with the formation of a collapsed volcanic caldera and the deposition of thick beds of tuff. Geophysical studies indicate that the region is one of relatively high-terrestrial heat flow, low-crustal density, low-crustal seismic velocities, low-crustal magnetoelectric impedance, and thin crust. 34 references. (auth)

**422** (ORO-4328-2, pp 192-344) BENTHIC ANIMAL-SEDIMENT. Mountford, N. K.; Phillips, D. K.; Mihursky, J. A. (Univ. of Maryland, Solomons). Aug 1973.

In ecological effects of nuclear steam electric station operations on estuarine systems. Volume II.

Hydrographic data (temperature and salinity), benthic fauna data (species, range, diversity, biomass), and sediment-grain size characteristics were determined in the vicinity of the proposed Calvert Cliffs Nuclear Power Station on the Chesapeake Bay system. (ERB)

**423** (ORO-4328-2, pp 345-399) BLUE CRAB IN CALVERT CLIFFS AREA OF CHESAPEAKE BAY. Sulkin, S. D.; Miller, R. E. (Univ. of Maryland, Solomons). Aug 1973.

In ecological effects of nuclear steam electric station operations on estuarine systems. Volume II.

The blue crab program carried out off the Calvert Cliffs site at established transect stations (Map 1) is part of a larger study conducted within the Chesapeake Bay System. Recent data have modified our concepts concerning blue crab movements and distribution. High wintering over densities of juvenile blue crabs in the Calvert Cliffs region occurred during the winter of 1969–70; however, during the winters of 1970–71 and 1971–72 the juvenile population was more dispersed. Apparently low temperatures are a limiting factor in halting dispersal. During the winter of 1969–70 a late movement may have occurred from the lower Bay and the timing with low temperatures halted the movement of a large number of juveniles in the Calvert Cliffs region. Movement of juveniles from the lower Bay apparently began earlier in subsequent years and resulted in a more widespread distribution in the Bay system before low limiting temperature prevailed. Thus, the Calvert Cliffs region is not a consistent wintering over area. The region does tend to support high densities of adult blue crabs, especially during the late summer and fall periods when large numbers of females are migrating south to the spawning grounds in the Bay mouth area. (ERB)

**424** (ORO-4328-2, pp 401-420) FISH SURVEY: OTTER TRAWL COLLECTIONS OFFSHORE OF THE CALVERT CLIFFS NUCLEAR POWER PLANT SITE. Koo, T. S. Y.; Ritchie, D. E. Jr. (Univ. of Maryland, Solomons). Aug 1973.

In ecological effects of nuclear steam electric station operations on estuarine systems. Volume II.

A survey was conducted of the bottom fishes in the vicinity of the proposed Calvert Cliffs Nuclear Power Station to determine the kinds of fish present, their relative abundance, and their seasonal variations. Salinity and water temperature were determined at each station at the time of the sampling. (ERB)

**425** (ORO-4328-2, pp 422-423) EFFECTS OF TEMPERATURE ON ESTUARINE MICROCOSMS. Heinle, D. R.; Flemer, D. A.; Ulanowicz, R. E. (Univ. of Maryland, Solomons). Aug 1973.

In ecological effects of nuclear steam electric station operations on estuarine systems. Volume II.

**426** (USGS-474-137) RECENT FAULT MOVEMENT ON PAHUTE MESA, NEVADA TEST SITE, FROM MAY 1970 THROUGH JUNE 1973. Snyder, R. P. (Geological Survey, Denver, Colo. (USA)). Oct 1973. Contract AT(29-2)-474. 32p. Dep. NTIS $4.00.

Seventeen fault-monitoring stations, each consisting of a sighting bar and target board, were installed across selected faults on Pahute Mesa, Nevada Test Site. Data collected by using these devices indicate that fault movements occur not only as the immediate result of nearby underground nuclear tests but, also, as continuing intermittent movement several months after underground testing. (auth)

**427** (USGS-474-173) LITHOLOGIC LOGS AND STRATIGRAPHIC IDENTIFICATION OF EXPLORATORY AND EMPLACEMENT DRILL HOLES IN AREA 4, NEVADA TEST SITE. Dixon, G. L.; Carr, W. J.; Aamodt, P. L. (Geological Survey, Denver, Colo. (USA)). Oct 1973. Contract AT(29-2)-474. 37p. (NTS-249). Dep. NTIS $4.00.

A compilation of lithologic logs of exploratory and emplacement holes in Area 4, Nevada Test Site is presented with emphasis on identification of Tertiary volcanic units. An index map showing drill-hole locations and elevation of the Tertiary water level in Area 4 is included. (auth)

**428** (USGS-474-177) STRATIGRAPHIC SECTION ON BALLOON HILL, NEVADA TEST SITE. Hinrichs, E. N. (Geological Survey, Denver, Colo. (USA)). Nov 1973. Contract AT(29-2)-474. 21p. (NTS-252). Dep. NTIS $4.00.

To aid in the correlation of airfall tuffs exposed on the eastern edge of Yucca Flat with those in drill holes in Areas 9 and 7, a stratigraphic section about 425 ft thick was measured along a cut bulldozed on Balloon Hill. Petrographic modal analyses were measured on 31 samples of a total 39; X-ray analyses were made on five samples. The section consists of three parts: a lower unit, the "Grouse airfall" (a field term for a distinctive unit associated with the Grouse Canyon Member of the Belted Range Tuff), and an upper unnamed tuff. The lower unit, of which only 34 ft is exposed, is characterized by a consistently high proportion of plagioclase in the phenocrysts. The "Grouse airfall" of the Belted Range Tuff, 12 ft thick, is the one distinctive stratigraphic marker in the section—it is vitric, moderate gray, and low in phenocrysts and lithic fragments. The upper unnamed tuff, about 380 ft thick, varies greatly in phenocryst composition and alteration of the pumice and shards in the groundmass. The distribution of clay minerals, zeolites, calcium carbonates, and silica suggests formation in place and transport. The interlayered brown argillic tuffs are interpreted as fossil soils. (auth)

## Thermal Effluents

*Refer also to abstract 396.*

**429** (ORNL-TM-4287) ONE-DIMENSIONAL ANALYSIS OF HEAT DISSIPATION IN A SIDEARM OF A COOLING LAKE. Dresner, L. (Oak Ridge National Lab., Tenn. (USA)). Oct 1973. Contract W-7405-eng-26. 25p. Dep. NTIS $3.25.

A simple one-dimensional theory was formulated describing surface cooling in blind sidearms of cooling lakes. The theory is based on an extension of Schijf and Schönfeld's equations of motion for the steady, non-uniform flow of a two-layered system. A numerical program to facilitate the computations is listed and illustrative results are given. (auth)

**430** (ORO-4328-1, pp 25-47) REFERENCE STATION METHOD FOR ASSESSING POWER PLANT EFFECTS ON TEMPERATURE, SALINITY, AND DISSOLVED OXYGEN (PRELIMINARY EVALUATION: CALVERT CLIFFS). Obremski, H. Martin Marietta Corp., Baltimore). Aug 1973.

In ecological effects of nuclear steam electric station operations on estuarine systems. Volume I.

A newly developed method for assessing the effects of a nuclear power plant on the physical conditions in the aquatic environment is described, and results obtained from applying this method to determining changes in the temperature, salinity, and dissolved oxygen conditions in Chesapeake Bay waters near the Calvert Cliffs nuclear power plant are presented. (LCL)

**431** (ORO-4328-1, pp 49-119) PRIMARY PRODUCTIVITY AND STANDING CROP OF PHYTOPLANKTON AT CALVERT CLIFFS, CHESAPEAKE BAY. Flemer, D. A.; Warneke, L. (Univ. of Maryland, Solomons). Aug 1973.

In ecological effects of nuclear steam electric station operations on estuarine systems. Volume I.

The results of field work that was completed between September 27, 1971 and March 15, 1973 are summarized. The objective of the field work was to document the seasonal and spatial distribution of the standing crop of phytoplankton and the potential primary production at Calvert Cliffs Nuclear Power Station. (ERB)

**432** (ORO-4328-1, pp 121-148) OCCURRENCE, ABUNDANCE, DISTRIBUTION, AND PRODUCTIVITY OF NANOPLANKTON AT STATION 2C, CALVERT CLIFFS AREA. Van Valkenburg, S. (Univ. of Maryland, Solomons). Aug 1973.

In ecological effects of nuclear steam electric station operations on estuarine systems. Volume I.

The occurrence, abundance, distribution, and productivity of nanoplankton (phytoplankton 10 $\mu$ or less in size) at the Calvert Cliffs area were determined. (ERB)

**433** (ORO-4328-1, pp 150-160) ZOOPLANKTON STUDIES. Heinle, D. R.; Millsaps, H. S. Jr.; Millsaps, C. V. (Univ. of Maryland, Solomons). Aug 1973.

In ecological effects of nuclear steam electric station operations on estuarine systems. Volume I.

The identity and abundance of zooplankton organisms in Chesapeake Bay waters in the vicinity of the Calvert Cliffs Nuclear Power Station were determined. Acarta tonsa was the most abundant organism present. (ERB)

**434** (ORO-4328-1, pp 161-191) MEROPLANKTON. Cooper, J. E.; Mihursky, J. A. (Univ. of Maryland, Solomons). Aug 1973.
In ecological effects of nuclear steam electric station operations on estuarine systems. Volume I.

Fish egg and larvae collections for the seven station array off the Calvert Cliffs site reveal that the Bay Anchovy and the Hogchoker dominate catches. Both are abundant, but non-commercial species in the Bay system. Greatest total abundance of eggs and larvae for all species combined occurs during May, June, July, and August. However, pertinent to the deep (26 to 40 ft) intake design of the steam electric station located at Calvert Cliffs, winter catches reveal a higher concentration of young fish in the bottom collections compared to the surface collections during this period. Such distribution undoubtedly will enhance probability of entrainment in the cooling water supply during winter. (auth)

**435** (ORO-4328-2) ECOLOGICAL EFFECTS OF NUCLEAR STEAM ELECTRIC STATION OPERATIONS ON ESTUARINE SYSTEMS. Volume II. Second Progress Report. Mihursky, J. A. (Maryland Univ., Solomons (USA). Natural Resources Inst.). Aug 1973. Contract AT(40-1)-4328. 263p. Dep. NTIS $15.25.

Separate abstracts were prepared for each of the four chapters and one appendix presented in volume II of this report. (ERB)

*For abstracts of individual chapters see: 422–425 and 436.*

**436** (ORO-4328-2, pp 424-453) TEMPERATURE, SALINITY, AND OXYGEN DATA FROM ROUTINE SEVEN STATION CRUISES. Aug 1973.
In ecological effects of nuclear steam electric station operations on estuarine systems. Volume II.

Tabulated data are presented from shipboard measurements of the temperature distribution, salinity, and dissolved oxygen content in Chesapeake Bay waters near the Calvert Cliffs nuclear power plant. The data were obtained during the period from Aug. 1971 to March 1973. (LCL)

**437** THERMAL POLLUTION AND ITS CONTROL. Hill, C. T. (Washington Univ., St. Louis). Environ. Aff.; 2: No. 2, 406-420(Fall 1972).

Thermal pollution as a result of waste heat being released to the environment from steam electric generating plants is discussed by considering the magnitude of the problem, the environmental effects of heated water discharge, thermal pollution control technology, economics of thermal pollution control, and beneficial uses of waste heat from power plants. (LCL)

**438** LEGAL AND REGULATORY FRAMEWORK FOR THERMAL DISCHARGE FROM NUCLEAR POWER PLANTS. Baram, M. S. (Massachusetts Inst. of Tech., Cambridge). Environ. Aff.; 2: No. 3, 505-532(Win 1972).

The problem of thermal water pollution as a result of heated cooling water being discharged from nuclear power plants into surface waters is discussed in terms of: the development of regulations for nuclear power plant siting and operation in order to control the effects of thermal pollution; organization of decision-making groups to implement these regulations; historical review of water pollution control laws and programs; the impact of the National Environmental Policy Act (NEPA) of 1970; and miscellaneous environmental bills, laws, and judicial decisions which affect the future of the nuclear power industry. It is concluded that advances in technology, reduction of consumption, and government and corporate responsibility under citizen scrutiny and pressure may eventually bring about a solution to the thermal pollution problem. (LCL)

## Chemical Effluents

***Refer also to abstracts 388, 406, 662, and 664.***

**439** (ANL-7960(Pt. 4)) RADIOLOGICAL AND ENVIRONMENTAL RESEARCH DIVISION ANNUAL REPORT, JANUARY–DECEMBER 1972. (Argonne National Lab., Ill.). 1972. Contract W-31-109-eng-38. 98p. Dep. NTIS $5.45.

Results are reported from: measurements of nocturnal wind flow over St. Louis; measurement of wind velocity and pressure at Chicago Midway Airport; micrometeorological measurements and determination of the average diurnal surface budgets and evaporation rate of the Great Lakes; and applications of wind turbulence statistics to predict pollution dispersions over water. (CH)

# INSTRUMENTATION

## Radiation Detection Instruments

**440** PAPERS AND PRESENTATIONS OF DIGITAL EQUIPMENT COMPUTER USERS SOCIETY SPRING SYMPOSIUM, BOSTON, MASSACHUSETTS, MAY 10–13, 1972. Maynard, MA; Digital Equipment Computer Users Society (1972). 389p. (CONF-720516–).

A separate abstract was prepared for 2 of the 62 papers presented at the conference. The remaining 60 papers were not in the subject scope of NSA. (TFD)

*For abstracts of individual papers see: 481 and 1097.*

### General Detectors and Monitors

*Refer also to abstracts 324, 849, 905, 906, 909, 1939, and 1989.*

**441** (BIPM–69-3) SIMPLE METHOD OF PRECISE MEASUREMENT OF DEAD TIMES. Mueller, J. W. (Bureau International des Poids et Mesures, 92 - Sevres (France)). 1969. 3p. (In French). Dep. NTIS (U. S. Sales Only) $3.00.

Replacement of the two sources by oscillators in the conventional device for measuring dead time was previously proposed. This proposition revealed very interesting results. The precision is no longer limited by the statistical fluctuations in radioactive sources and not any assumption intervenes on the small interval distribution, as the new distribution is entirely determined by the two frequencies. Calculations are simple without approximations and can be made for both types of dead times. Under stable conditions (quartz oscillator) the measurement of both frequencies does not present any problem and the accuracy in measuring dead times easily reaches 1%. (FR)

**442** (BIPM–69-11) NEW METHOD FOR MEASURING DEAD TIMES. Mueller, J. W. (Bureau International des Poids et Mesures, 92 - Sevres (France)). 1969. 3p. (In French). Dep. NTIS (U. S. Sales Only) $3.00.

It is envisaged to replace the two radioactive sources in the conventional device for measuring dead times by periodical pulse generators. Measurements effected by the method were quite good. (FR)

**443** (BIPM–71/2) NEW TYPE OF RANDOM COINCIDENCES. Mueller, J. W. (Bureau International des Poids et Mesures, 92, Sevres (France)). 1971. 5p. (In French). Dep. NTIS (U.S. Sales Only) $3.00.

A possible source of errors, which appears to have been misunderstood until now, is pointed out. It is possible to alter coincidence countings if simple precautions are not taken: one pulse (beta or gamma) may occasionally generate two random coincidences. It appears that this complication can be avoided if the resolution time for the coincidences does not exceed an upper limit imposed by the dead times of the two channels. (FR)

**444** (BIPM–72/7) LIMITING BEHAVIOUR OF THE INTERVAL DENSITY FOR AN EXTENDED DEAD TIME. Mueller, J. W. (Bureau International des Poids et Mesures, 92, Sevres (France)). 1972. 7p. Dep. NTIS (U.S. Sales Only) $3.00.

A recent semi-empirical method for determining the correction to the number of counts due to a nonideal dead time is based on the assumption that the interval density becomes an exponential function for sufficiently large time intervals. It is shown that this result holds for the two extreme cases of extended- or the non-extended-type dead times. The dead time is assumed to be inserted into a process of originally Poissonian nature with count rate rho. Two different approaches are discussed; the first is based on the original interval density, while the second starts with its integral transform. (FR)

**445** (BIPM–72/9) EFFECT OF TWO EXTENDED DEAD TIMES IN SERIES. Mueller, J. W. (Bureau International des Poids et Mesures, 92, Sevres (France)). 1972. 7p. Dep. NTIS (U.S. Sales Only) $3.00.

An attempt is made to determine in an exact way the influence of two consecutive dead times of the extended type on the count rate if they are inserted into a sequence of pulses. The original process, which may be due to the decays of a radioactive source, is assumed to be of the Poisson type; it is shown that insertion of the first dead time results in increasing the count rate at the output rather than diminishing it. (FR)

**446** (BIPM–72/13) SOME NOTES ON PAIR STATISTICS. Mueller, J. W. (Bureau International des Poids et Mesures, 92, Sevres (France)). 1972. 12p. Dep. NTIS (U.S. Sales Only) $3.00.

It is assumed that the parent and the daughter pulses stemming from a two-step nuclear decay cannot be readily distinguished, as for example is usually the case for beta particles and highly converted gamma rays. A "pair" is said to be counted if both the parent and the daughter pulse from a specific decay have been registered within a certain measuring time T, all other pulses being denoted singles. The intermediate state has a mean lifetime $\lambda^{-1}$ and the detection efficiencies of the counters for the parent and daughter pulses are considered; dead-time effects not being taken into account. The interest is focused on the statistical behavior of the total process which consists of the random superposition of parent and daughter pulses. (FR)

**447** (BIPM–72/14) NEW METHOD FOR DISTINGUISHING BETWEEN PAIRS AND SINGLE PULSES. Mueller, J. W. (Bureau International des Poids et Mesures, 92, Sevres (France)). 1972. 10p. Dep. NTIS (U.S. Sales Only) $3.00.

The interest is focused on spurious pulses which are an obvious and permanent nuisance in all measurements of absolute disintegration rates. Apart from a few rare cases where pulse-height analysis is possible, all techniques use, in one way or another, the time relationship which exists between the corresponding genuine and spurious pulses. Within this general approach, two main variants can be distinguished. Either the time distribution of the intervals is measured, or one analyzes the relative variance in the number of registered counts which can be deduced from repeated measurements. The merits and drawbacks of these interval and counting techniques are discussed. (FR)

**448** (BIPM–73/5) COMPLEX MODULO K COUNTER. Mueller, J. W. (Bureau International des Poids et Mesures, 92, Sevres (France)). 1973. 16p. Dep. NTIS (U.S. Sales Only) $3.00.

An attempt is made for distinguishing between single and paired events in the case of multiple pulses. This problem is at present probably only of minor practical importance, but it appears in the context of afterpulses. The traditional methods do not lend themselves easily to a convenient treatment. The present approach is based on a rather straightforward extension of the correlation function to more than two states. (FR)

**449** (BIPM–105) INTERVAL-DISTRIBUTION FOR RECURRENT EVENTS WITH A NON-EXTENDED DEAD TIME. Mueller, J. W. (Bureau International des Poids et Mesures, 92, Sevres (France)). [nd]. 7p. Dep. NTIS (U.S. Sales Only) $3.00.

The arrival of impulses at a counter is considered and it is assumed that this sequence of events forms a recurrent (or renewal process). It is also assumed that a fixed resolving (or dead) time is inserted in this sequence by a non-paralyzable counter or by a circuit specifically designed for this purpose. The interval distribution for such a sequence is determined and it is shown that the dead time does not simply produce a cut-off or a shift of the original interval-distribution, but may change its shape completely. (FR)

**450** (BIPM–106) INFLUENCE OF TWO CONSECUTIVE DEAD TIMES. Mueller, J. W. (Bureau International des Poids et Mesures, 92, Sevres (France)). [nd]. 7p. Dep. NTIS (U.S. Sales Only) $3.00.

In general, the insertion of a dead time in an electronic circuit changes the stochastic features of a sequence of transmitted pulses. The problem of the deformation of an original interval-distribution to the new probability density function, caused by a dead time, has been already treated. However, the combined effect of such dead times "in series" on the final interval density is discussed within the limits of two consecutive non-extended dead times and the case of an original Poisson distribution. (FR)

**451** (BIPM–111) COUNTING STATISTICS OF A POISSON PROCESS WITH DEAD TIME. Part 1. General Relations. Mueller, J. W. (Bureau International des Poids et Mesures, 92, Sevres (France)). [nd]. 14p. Dep. NTIS (U.S. Sales Only) $3.00.

A review is given with emphasis primarily on exact results for the probability distributions, the expectations and the variances for the number of registered counts for some simple and well-defined experimental situations. They should offer optimum conditions for a reliable comparison with the measurements and therefore for extracting a maximum of information. These exact expressions are usually more complicated than the corresponding approximations used until now, but this drawback seems to be largely compensated by the advantage, especially when an electronic computer is available, of avoiding possible systematic errors. The essential steps in the derivation are discussed. Particular attention is given to the different possibilities of choosing the beginning of the counting interval. (FR)

**452** (BNL-18221) TEXT, FIGURES, AND EXAMPLES FOR THE REFRESHER COURSE "PRACTICAL STATISTICS FOR THE HEALTH PHYSICIST". Ash, J. A. (Brookhaven National Lab., Upton, N. Y. (USA)). 11 Sep 1973. 25p. (CONF-730603-13). Dep. NTIS $3.25.

From eighteenth Health Physics Society meeting; Miami Beach, Florida, USA (17 Jun 1973).

A refresher course to provide a practical approach to the use of statistical concepts in interpreting data related to problems of applied health physics is given. After a brief review of the theoretical probability distributions, emphasis is placed on counting statistics, in particular the concept of the standard deviation. In this category the following topics are covered: (1) calculation of the standard deviation, (2) propagation of errors (when two or more quantities are combined arithmetically or via a formula), (3) confidence limits, and (4) the null hypothesis. The following topics are also discussed: (1) Chi-Square in relation to checking the reliability of a counting instrument, (2) correction factors for deadtime losses, and (3) for the case of a decaying source. (auth)

**453** (CONF-700867-, pp 218-221) TRANSIENT RESPONSE OF COBALT SELF-POWERED NEUTRON DETECTORS. Boeck, H.; Stimler, M.; Strindehag, O. (Oesterreichische Hochschule, Vienna). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

Specifications are given for the cobalt self-powered neutron detector tested in the TRIGA reactor core. Results show that the cobalt detector has a response as fast as the ionization chamber and is fast enough to be used in reactor control and safety instrumentation systems. (WDK)

**454** (JINR-P6-7355) INFORMATION REDUCTION TECHNIQUE IN GAMMA-GAMMA COINCIDENCE EXPERIMENTS. Gromov, K. Ya.; Zaidler, Z.; Ormandzhiev, S.; Fominykh, V. I.; Fominykh, M. I.; Tsupko-Sitnikov, V. M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 15p. (In Russian). Dep. NTIS (U.S. Sales Only) $3.00.

A one-line experiment on gamma-gamma coincidences is described when voluminous data are recorded in a compact form. For the two-dimensional events instead of recording the codes of its $A_i$ and $B_j$ parameters in the direct form, their functional transformation giving the number $C = f(A_i, B_j)$ is introduced. The f(A,B) transformation must include the operations limiting the range of the C number according to the real memory capacity. The (A,B) coordinate plane is transformed into the axis $C = f(A,B)$ at each point $C_k$ of which all the information located at the plane (A,B) at the curve $f(A,B) = C_k$ is collected. To reproduce the coincidence pattern, in a general case, it is necessary to record the integral spectra of coincidences for each parameter (the transformations: $C_k = A_i = \text{const}$, $C_k = B_j = \text{const}$) and one of the transformation spectra with both the parameters, e.g., $C_k = (A + B) = \text{const}$, $C_k = \sqrt{A \times B} = \text{const}$, $C_k = \sqrt{A^2 + B^2}$. The memory capacity necessary for data accumulation is about $(K + 1)n$ channels (where K is the number of parameters and n is the level of their digitalization) instead of the $n^K$ channels for an ordinary experimental arrangement. Some reduction of sensitivity due to background summation is a disadvantage of this technique. The small memory capacity sufficient for data accumulation with the possibility of extracting all the qualitative and quantitative information on coincidences, the possibility of operating in the integration mode and the visual control for the experimental procedure is an advantage of this technique. This method is suitable to be employed at small fast computers when the urgent evaluation of coincidences is required, the preliminary information being absent. The technique test made when investigating gamma-gamma coincidences for $^{95m}$Tc allowed the development of the decay scheme which agrees well with the results obtained by other methods. (auth)

**455** (JINR-P10-7302) ANALYSIS OF EXPERIMENTAL DATA TAKING INTO ACCOUNT DETECTOR CORRELATIONS. Markovski, B. L.; Khristov, Kh. Ya.; Yaneva, N. B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1973. 24p. (In Russian). Dep. NTIS (U.S. Sales Only) $3.25.

The case of data registration with a nonzero possibility of simultaneous registration of a particle by more than one detector is considered. The explicit maximum likelihood function for such a problem is found. The approximative formulas corresponding to "rich" statistics and small correlations are given. (auth)

**456** (ORNL-TM-1251(Rev.)) DESCRIPTION OF THE FACILITY RADIATION AND CONTAMINATION ALARM SYSTEM INSTALLED IN THE HIGH RADIATION LEVEL EXAMINATION LABORATORY, BLDG. 3525. Hall, C. C.; Lovvorn, J. L. (Oak Ridge National Lab., Tenn. (USA)). Oct 1973. Contract W-7405-eng-26. Dep. NTIS $3.25.

A Facility Radiation and Contamination Alarm System was installed in the High Radiation Level Examination Laboratory, Building 3525, to continuously monitor beta and gamma radiation and airborne beta-gamma contamination. A monitor was installed in an exhaust duct to determine beta-gamma contamination carried in the exhaust duct. The radiation monitoring instruments and associated system components provide health physics information and sound local and remote alarms when abnormal conditions occur. Radiation monitoring instruments actuate the building evacuation system when specific levels of radiation or contamination are reached. (auth)

**457** (PTB-ND-4) PROGRAM FOR CALCULATING THE RESPONSE FUNCTION OF ORGANIC SCINTILLATORS FOR INCIDENT MONOCHROMATIC NEUTRONS IN THE ENERGY RANGE FROM 0.05 TO 20.0 MeV. Dietze, G. (Physikalisch-Technische Bundesanstalt, Brunswick (F. R. Germany)). Jun 1973. 35p. (In German). Dep. NTIS (U. S. Sales Only) $3.75.

A Monte Carlo program is described for calculating the response function of a scintillation counter with an organic scintillator induced by monoenergetic neutrons in the energy range from 0.05 to 20.0 MeV. (auth)

**458** (UCRL-51422, pp 1-5) COMPARISON OF THE ABSOLUTE BORRMANN TRANSMISSION OF Ge AND CdTe DETECTOR GRADE CRYSTALS. Pickles, W. L.; Elliott, J. H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Jul 1973.

In fiscal year 1973 summary report for the USAEC Division of Applied Technology: environmental analysis.

A study was conducted to compare the transmission qualities of detector grade Ge with samples of detector grade CdTe and to determine if the CdTe crystals were sufficiently ordered to allow any Borrmann transmission. If the CdTe crystals exhibit strong Borrmann effects, the implication is that the crystal order is at least as good as that of detector grade Ge. The transmission of 21.5 keV x-rays through the single crystal germanium used in the study was found to be $1.2 \times 10^{-4}$. This is $6 \times 10^3$ greater than expected in polycrystalline germanium. The absolute transmission measured through the CdTe was significantly higher at $3.2 \times 10^{-3}$. This result should be useful as an evaluation tool for anyone producing high quality Ge or CdTe crystals. (TFD)

**459** ORDINATOR SMOOTHING OF NUMERICAL SCINTILLOGRAMS. Martin, J. (Section d'Informatique Medicale et Service d'Exploration Fonctionnelle par les Radioisotopes, Nancy); Legras, B.; Portmann, M. C. Int. J. Nucl. Med. Biol.; 1: No. 1, 45-49(Jan 1973). (In French).

The validity of initial smoothing has been studied in relation to ordinator treatment of numerical scintillograms. Empirical tests have been made by data processor, by simulation, and by analyzing a scintillogram of a liver phantom of the method of smoothing by successive means, and of different methods of approximation by least squares. (auth)

**460** CADMIUM CORRECTION FACTORS OF SEVERAL THERMAL NEUTRON FOIL DETECTORS. Mueck, K.; Bensch, F. (Atominstitut der Oesterreichischen Hochschulen, Vienna). J. Nucl. Energy; 27: No. 9, 677-688(Sep 1973).

If the epithermal activation $C_{ep}$ of a foil detector is derived from its epicadmium activation $C_{Cd}$, the knowledge of the cadmium correction factor $F_{Cd} = C_{ep}/C_{Cd}$ is usually required. The cadmium correction factors of V, B, $^{10}$B, In, Au, Mn, Co, and Dy foil detectors of thicknesses up to 0.25 mm and cadmium cover thicknesses of 0.5, 0.8, 1.0, and 1.2 mm have been numerically evaluated according to the most recent cross-section values and resonance parameters. $F_{Cd}$ values are listed for both monodirectional and isotropic neutron incidence. While for most of these materials no results have been published so far, for gold and indium the results could be compared with previous calculations and measurements, and a discussion of the results is given. Since the $F_{Cd}$ values, particularly for Mn, Co, and Dy, exceed unity considerably, neglecting this correction is not tolerable with precise measurements of the thermal neutron flux density. Comments on the use of $F_{Cd}$ values in the Westcott convention are added. (auth)

**461** TECHNOLOGICAL FEASIBILITY OF A PROPOSED SEMICONDUCTOR RADIATION DETECTOR. Vann, H. R. St. Louis; Washington Univ. (1973). 153p. University Microfilms Order No. 73-24,927.

Thesis (Ph. D.).

Semiconductor radiation detectors are generally operated as solid state ionization chambers. The active region is required to have a low free carrier density. Large electric fields are impressed across the active region to sweep out the electron-hole pairs which result from an interaction between incoming radiation and the semiconductor. While the resulting detectors are the most sensitive available and additionally give the best energy resolutions, the processing problems involved in producing reasonably reliable detectors are formidable. The result is low yields and high prices. In the proposed semiconductor detector, the active region has an electric field applied which is orders of magnitude below that of conventional detectors. The minority carriers which result from the interaction of radiation with the semiconductor are drifted by this electric field to a region near the depletion layer formed by the base-collector junction of a transistor structure which is an integral part of the detector. Those carriers which are captured by the electric field of the depletion layer are swept into the transistor base region, forming a base current which is amplified. An analytical design procedure is developed and a set of parameters proposed which, if met, should assure proper device operation. A technology is then developed which is used to make devices in silicon whose parameters meet or exceed those proposed. The analysis includes expressions for the leakage currents which could be expected in the device. These currents are important in determining minimum detectable signals. Because the transistor structure must maintain high gains at very low collector currents, expressions for the loss mechanisms in the transistor are developed so that they might be minimized. The problem of power dissipation in the device is also treated. The most important finding was the necessity for maintaining high carrier lifetimes throughout all the processing steps. Additionally, there was a need to minimize controllably the surface state density at the silicon–silicon dioxide face. Based on these requirements, a set of processes was developed which could be used to produce silicon detectors with minority carrier lifetimes probably greater than ten microseconds, surface state densities less than $1 \times 10^{11}$ $cm^{-3}$ and having integral transistor structures with gains greater than one hundred at collector currents of ten to twenty microamperes. These devices were not tested as radiation detectors but based on the technical analysis, they should function. The study of the detector in silicon was a convenient method for assessing the feasibility of the device. For a practical device, germanium with its greater absorption probability and its greater electron mobility is a more interesting material. Although many of the questions investigated in this study are specific to the silicon device, the analysis and proposed design are applicable to a germanium device, and no specific issues were encountered which precluded the manufacture of such a device. (Diss. Abstr. Int., B)

**462** EQUIPMENT STABILITY IN X-RAY FLUORESCENCE SPECTROMETRY AND RADIOACTIVE COUNTING: A STATISTICAL APPROACH. Hooton, K. A. H.; Parsons, M. L. (Arizona State Univ., Tempe). Anal. Chem.; 45: No. 13, 2218-2227(Nov 1973).

Unstable conditions in the component units of x-ray fluorescence spectrometers and radioactivity counting equipment can result in serious errors of analysis. The mean square successive difference (MSSD) method is introduced for the first time to reveal drift or oscillations. Drift and large oscillations present together can be detected by new statistics developed from the MSSD method. The chi-squared test, analogous to its use in radioactivity counting, has been adopted for x-ray fluorescence spectrometer stability testing and is used in conjunction with the MSSD method. These combined methods are more sensitive than the present criterion for acceptable equipment stability in which the set of observed replicate counts is expected to lie within the range of $\pm 3\ \sigma$ about the mean. Drift often can be detected with fewer observations than previously and abnormal distributions of observations, not found by the $3\ \sigma$ criterion, are detected. The combined statistical tests are applied expeditiously by means of a desk calculator. (auth)

**463** RADIATION AND PARTICLE DETECTOR AND AMPLIFIER. Schmidt, K. C. US Patent 3,758,781. 11 Sep 1973. Filed date 15 Jul 1969. 6p.

A radiation or charged particle detector which incorporates a channel multiplier structure to amplify the detected rays or particles is described. The channel multiplier structure has a support multiplying element with a longitudinal slot formed along one side thereof, and the element supports a pair of plates positioned contiguous with the slot. The plates are adapted to funnel the particles or rays to be detected into the slotted aperture and ultimately the element, thus creating an effectively wide aperture detector of the windowless type. (Official Gazette)

**464** NUCLEAR RESEARCH EMULSIONS. II. Particle Behavior and Emulsion Applications. Barkas, W. L. Pure and Applied Physics. Volume 15-II. New York; Academic Press, Inc. (1973). 475p. $36.00.

Chapter topics include relativistic particle motion, particle identification, particle interactions in emulsions, emulsion stars, electron and photon processes in emulsions, neutron measurements, epitome of particle behavior, applications in cosmic ray research, applications in nuclear physics, applications in earth sciences, applications in biological sciences, and experimental procedures. An extensive list of references is included. (WHK)

**465** METHODS OF CONTROLLING QUENCHING IN EXTRACTIVE SCINTILLATORS FOR LIQUID SCINTILLATION COUNTING OF ALPHA-EMITTING NUCLIDES. McDowell, W. J.; Coleman, C. F. (Oak Ridge National Lab., TN). Anal. Lett.; 6: No. 9, 795-799(1973).

Problems in alpha energy resolution and identification in liquid scintillation are noted, and the advantages of using organic-phase-soluble extractants to incorporate alpha-emitting nuclides into the scintillator are discussed. The quenching effects of seven extractants are examined and are found to be in the order: tributyl phosphate < di(2-ethylhexyl)–phosphoric acid = trioctylphosphine oxide < didecylamine sulfate = 1-nonyldecylamine sulfate < trioctylamine chloride < trioctylamine nitrate. Some general techniques for improving pulse height and resolution of a liquid scintillator are described. (auth)

**466** CALIBRATION OF LIQUID SCINTILLATORS. Hoegl, A.; Schwerdtel, E. (to Frisieke and Hoepfner GmbH). German Patent 1,913,556. 1 Oct 1970. Filed date 18 Mar 1969. (In German).

A procedure for the elimination of the dependence of the liquid height (filling height) in the calibration of liquid scintillators contained in sample tubes is described. The energy of the standard radiation device is chosen in such a way that the radiation would be absorbed for a large part of the liquid scintillator. It is placed in a position so that the above-mentioned liquid is irradiated from the top. (TSS)

**467** PORTABLE APPARATUS FOR MEASURING NUCLEAR RADIATION. Jordan, K.; Kuhnert, H.; Hofmann, J. (to Frieseke and Hoepfner GmbH). German Patent 1,805,114. 21 May 1970. Filed date 25 Oct 1968. (In German).

A battery-operated, portable apparatus for measuring nuclear radiation in several regions is described. Under a window of the unit is found a graduated cylinder with a needle coupled to a device for traversing the region of measurement. The apparatus is characterized by the fact that the vessel around the graduated cylinder is traversed by a sort of pin that has an ampoule at its extremity. (TSS)

**468** ENERGETIC HEAVY-PARTICLE DETECTION BY PHOTOCHROMIC MATERIAL. Ouseph, P.J. (Physics Department, University of Louisville, Louisville, Kentucky, 40208). Phys. Rev. Lett. 30: No. 23, 1162-1165 (4 June 1973).

Mechanisms are discussed by which radiations can produce color changes in Fe-doped $SrTiO_3$. α-particle and cosmic-ray (π-meson) absorption events have been detected by these crystals. (auth)

## *Radiation Dosimeters*

**469** PROCEDURE FOR THE MEASUREMENT OF THE NEUTRON IRRADIATION DOSE, DESCRIPTION OF THE SYSTEM AND THE MONITOR. Mathieu, F. G. (to Centre d'Etude de l'Energie Nucleaire). Belgian Patent 798,823. 16 Aug 1973. 30p. (In French).

A procedure is described for the measurement of the neutron irradiation dose characterized by the fact that one introduces into the irradiation region an element of which the thermoelectric properties vary as a function of the integrated neutron flux, that one subjects the irradiated part of the element to a temperature gradient, that one measures the emf thus produced, and that one deduces the irradiation dose from this emf. The description of a device characterized by the fact that it comprises as a couple, the thermoelectric properties of which vary perceptibly as a function of the integrated neutron flux, a platinum wire and a platinum–rhodium wire, and another characterized by the fact that it comprises as a couple, the thermoelectric properties of which do not vary perceptibly as a function of the integrated neutron flux, a chromel wire and an alumel wire is given. (tr-auth)

## *Nuclear Spectroscopic Instrumentation*

*Refer also to abstract 1048.*

**470** (CEA-R-4504) (α,n) NEUTRON SPECTRA DETERMINATION BY LIQUID SCINTILLATOR SPECTROMETER TECHNIQUE. Capgras, A.; Ronteix, C.; Sueur, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91, Gif-sur-Yvette (France)). Oct 1973. 27p. (In French). Dep. NTIS (U.S. Sales Only) $3.50.

An organic liquid scintillator spectrometer, developed for studying $(\alpha,n)$ sources, is described. A pulse shape discrimination has been used to eliminate $\gamma$ effects. The spectra of $^{241}$Am-Be and $^{239}$Pu-Be sources are determined in the energy range 1.5 to 12 MeV. (auth)

**471** RECOMMENDATIONS ON THE CHOICE OF EFFECTIVE THRESHOLDS AND NEUTRON ACTIVATION CROSS-SECTIONS. Kramer-Ageev, E. A.; Troshin, V. S.; Borisov, G. A.; Vasil'ev, R. D.; Galiev, N. B.; Grigor'ev, E. I.; Yaryna, V. P. Meas. Tech. (USSR) (Engl. Transl.); 16: No. 1, 96-97 (Jan 1973).

Translated from Izmer. Tekh.; 16: No. 1, 61(Jan 1973).

A system of equations for regenerating the neutron spectrum from data from a group of activation detectors is given and discussed. Effective thresholds, effective cross sections, and the relative percentage error of the effective cross section for 23 threshold reactions are tabulated. (WHK)

**472** IZMERITEL'NAYA TEKHNIKA V INSTRUMENTAL'NOM NEITRONNO-AKTIVATSIONNOM ANALIZE. (Measuring Techniques and Instrumentation in Neutron-Activation Analysis). Egiazarov, B. G.; Korytko, L. A.; Sel'dyakov, Yu. P. Moscow; Atomizdat (1972). 216p.

The book is divided into four parts. The first part deals with typical experimental arrangements and nuclear reactions, with the analysis of impurities or trace amounts of elements from pure gamma emitters, with interferring reactions, with factors having an effect on the analytical error and threshold sensitivity, with automated systems, and with single-element and multiple-element analysis. A number of complex systems are described in detail. Transport systems, neutron generators, and counters are covered. The second part deals with the spectrometry of gamma radiation by scintillation and semiconductor detectors, and the use of computers in activation analysis. The shape of the gamma line is discussed. The mathematical methods include the selection of optimal time intervals for irradiation, cooling and counting, counting statistics, error estimation, and treatment of the measurements results for smoothing, correcting, and determining the maximum peak height and area under the photopeak. The third part deals with a description of a highly automated system which includes a neutron generator, a wide-range gamma counter, an irradiation chamber, a pneumatic transport system, automated counting of the irradiated sample and standard, a computer, and a central control panel. The various parts of the automated unit are discussed for single-element analysis. The use of the automated equipment for multi-element analysis is discussed in part four. 277 references. (SJR)

**473** SCINTILLATION CRYSTAL FOR GAMMA RADIATION DETECTION. Nitschmann, G. (to Ernst Leitz GmbH). German Patent 1,938,386. 18 Feb 1971. Filed date 29 Jul 1969. (In German).

A scintillation crystal for the detection of gamma radiation, and especially for gamma spectroscopy, composed of barium iodide activated by europium, is described. (TSS)

### *High Energy Physics Instrumentation*

**474** (IFVE-SPK-72-33) TELEVISION OBSERVATION OF BUBBLE CHAMBER FILMS. Dobrynin, E. M.; Utochkin, B. A. (Gosudarstvennyi Komitet po Ispol'Zovaniyu Atomnoi Energii SSSR, Serpukhov. Institut Fiziki Vysokikh Energii). 1972. 8p. (In Russian). INIS.

Results are given on studies of the television observation of photographs of a bubble chamber on a closed-type unit having 1125 lines at 50 half-frames per second. As an example of the photography on the video-control unit it is shown that the television system with high resolution assures good quality of observing separate parts of a photograph on 70-mm film with an 80" hydrogen bubble chamber. Sections having the following dimensions were investigated: 38 × 38 mm$^2$ (at a magnification of 8), 17 × 17 mm$^2$ (at a magnification of 18), and 10 × 10 mm$^2$ (at a magnification of 30). (auth)

**475** (JINR-P1-7309) INVESTIGATION OF A 90-CHANNEL Pb GLASS CHERENKOV HODOSCOPE. Astvatsaturov, R. G.; Ivanov, V. I.; Knapik, E.; Kramarenko, V. A.; Kulakov, B. A.; Melkumov, G. L.; Malakhov, A. I.; Khvastunov, M. S.; Khachaturyan, M. N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1973. 14p. (In Russian). Dep. NTIS (U. S. Sales Only) $3.00.

The properties of the 90-channel Pb glass Cherenkov hodoscope were investigated in the electron beam at 2.3 and 4 GeV. The average energy resolutions (full width at half maximum) are as follows: 7.2% at 2 GeV, 6.0% at 3 GeV, and 5.3% at 4 GeV. (auth)

**476** (JINR-P10-7358) ALGORITHM OF INADEQUATE POINTS FOR DETERMINATION OF GEOMETRY OF THE EVENTS RECORDED IN A XENON BUBBLE CHAMBER. Slovinskii, B.; Tomashevich, A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1973. 10p. (In Russian). Dep. NTIS (U. S. Sales Only) $3.00.

An algorithm is suggested for the determination of the lengths and emission angles of charged particles recorded in a xenon bubble chamber. The algorithm is based on the measurements of inadequate points located at two projections of the charged particle tracks. The suggested way of analyzing the measurement results speeds up considerably the measurements and allows the rough errors to be avoided. (auth)

**477** (JINR-P13-7171) MAGNETIC SPECTROMETERS AT SPARK AND STREAMER CHAMBERS. Nikanorov, V. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 19p. (In Russian). Dep. NTIS (U.S. Sales Only) $3.00.

The influence of the magnetic field on the accuracy of parameter measurements for high-energy particle tracks on the memory time and particle recording efficiency is considered. Physical-technical characteristics of magnetic spectrometers are presented. (auth)

**478** (JINR-P13-7172) HIGHLY EFFICIENT CIRCULATING SYSTEM OF GAS CLEANING FOR SPARK CHAMBERS. Bogomolova, L. K.; Vasilenko, A. T.; Zykin, Yu. N.; Egorov, A. I.; Nikanorov, V. I.; Pisarev, A. F.; Pisarev, V. F. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 11p. (In Russian). Dep. NTIS (U.S. Sales Only) $3.00.

A system is described for a circulating cleaning gas system for a 5-meter magnetic spark spectrometer. Activated carbon, cooled to liquid nitrogen temperature, is used as the working substance. (auth)

**479** (JINR-P13-7206) DYNAMICS OF VAPOR BUBBLE IN HELIUM AND HYDROGEN ULTRASONIC CHAMBERS. Tkachev, L. G.; Shestakov, V. D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 13p. (In Russian). Dep. NTIS (U.S. Sales Only) $3.00.

The results are presented of experimental and theoretical investigations of track formation in a liquid-hydrogen bubble chamber in the ultrasonic field. Different physical phenomena are considered characterizing the dynamics of the vapor pockets. The dynamics of the nucleating bubble was studied. Cavitation and diffusion thresholds were determined as well as the dependence on the initial phase and surface tension. (auth)

**480** (LBL-2064) CHARACTERISTICS OF MULTIWIRE PROPORTIONAL COUNTERS WITH DELAY LINE READOUT FOR MINIMUM IONIZING PARTICLES. Stetz, A. W.; Perez-Mendez, V. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1973. Contract W-7405-eng-48. 17p. Dep. NTIS $4.00.

The effects of gas mixture and chamber thickness on the gain and pulse shape of a multiwire proportional counter with delay line readout were studied. The primary concern was with optimizing the position accuracy for high-energy particle physics applications. The best results, both from the point of view of chamber gain and the risetime and uniformity of the delay line pulses were obtained with a 4 mm gap chamber run on a mixture of 30% carbon dioxide and 70% argon. It was found necessary to bias the outer grids negative with respect to ground to prevent electrons in the drift regions from migrating into the multiplication region and spoiling the delay-line pulse shape. (auth)

**481** REAL-TIME DATA COLLECTION SYSTEM FOR TEN ON-LINE STATIONS. Stern, M. (Argonne National Lab., Ill.). pp 93-95 of Papers and Presentations of Digital Equipment Computer Users Society Spring Symposium. Maynard, MA; Digital Equipment Computer Users Society (1972).

From digital equipment computer users society spring symposium; Boston, Massachusetts, USA (11 May 1972). See CONF-720516–.

A PDP-15 connected to ten film stations is used to extract data from bubble chamber film. The computer directs the operator at each station through the extraction procedure. Information about each frame, entered by the operator through a keyboard and footpedal, is collected and stored on a magnetic tape. (auth)

## Radiometric Instruments

*Refer also to abstract 1723.*

**482** (ITJ-42) TWO-DETECTOR PROBE OF A PULSED NEUTRON GENERATOR. Chrusciel, E.; Dabek, T.; Massalski, J.; Morstin, K.; Owsiak, T.; Starzec, A. (Akademia Gorniczo-Hutnicza, Krakow (Poland). Instytut Techniki Jadrowej). May 1973. 35p. (In Polish). Dep. NTIS (U.S. Sales Only) $3.75.

A borehole neutron generator probe of 90 mm diameter is described. This tool is provided for geophysical work, in which the neutron diffusion parameters of rock formations are determined. From these, much information about lithology and reservoir rock characteristics can be derived. The borehole neutron generator consists of the down-hole probe and the surface equipment. The accelerator-type neutron tube is the most important element of the probe. The 14 MeV neutrons from the D-T reaction are generated in the probe, in pulses of 100 μs width and 400 Hz frequency. There are also two independent scintillation-type detectors in the probe, as well as the electronics, i.e., pulse-shaping, control and information transfer circuits. The probe is connected with the surface equipment by means of a triple channel logging cable. The surface equipment consists of the 220 V, 400 Hz supplier, the surface control circuit, the pulse-height analyzer, the multichannel time analyzer, and the photorecorder. The principles of pulsed neutron measurements with the probe are also presented, as well as the results of first model tests. (auth)

**483** NORWEGIAN PRODUCED NUCLEAR INSTRUMENTS. Tek. Ukebl.; 120: No. 38, 58(13 Sep 1973). (In Norwegian).

A number of radiometric instruments produced by Noratom-Norcontrol A/S for industrial use are briefly described. A conveyor-belt weighing instrument intended for use in the chemical, mining, cement and woodpulp industries has an accuracy in most cases better than 0.5%. A densimeter is marketed which may be applied in the same industries as well as for measurement of the degree of pollution in sewage and industrial effluents. Noratom's moisture gage was originally designed for measuring the moisture content of coke for smelting furnaces but is now also used for coal, ores, sand, etc. Level indicators which may be mounted outside silos, tanks or pipes are specially designed for use where temperature, pressure, etc., preclude the use of conventional instruments. (NO)

**484** RADIOIZOTOPNYE PRIBORY V PROMYSHLENNOSTI STROITEL'NYKH MATERIALOV. (Radioisotopic Instruments in the Construction Material Industry). Lobanov, E. M. (ed.). Moscow; Atomizdat (1973). 192p.

Continuous measurement of the refractory lining of rotary furnace kilns with $^{60}$Co gamma sources and scintillation counting is described in Chapter 1. The height of the layer of material in the rotary kiln is determined by transmission measurements from $^{60}$Co sources (Chap. 2). The amount of dust in the exit gas from a cement kiln is determined automatically by measuring the attenuation of beta particles through a layer of dust particles filtered out of the gas stream (Chapter 3). The decarboxylation of calcium carbonate can be automatically determined by radioisotopic transmission measurements, since the density of the calcined material is less than that of the uncalcined material (Chapter 4). Ore densification was determined by measuring transmitted gamma rays from $^{137}$Cs and $^{60}$Co sources (Chapter 5). Automatic control of the structural characteristics of a suspended layer of solid particles is covered in Chapter 6. The control of the production of burned lime by radioisotopic methods of measuring material density is discussed in Chapter 7. Radioisotopic methods used in measuring the flow of solid materials are discussed in Chapter 8. Activation analysis to control the composition of raw materials in cement production is covered in Chapter 9. Radioisotopic counters as systems of automatic control are discussed in Chapter 10. (SJR).

**485** UNIVERSAL RADIOMETRIC GAGE. Rozsa, A. (Magyar Tudomanyos Akademia Izotop Intezete, Budapest). Elektronik (Munich); 22: No. 6, 209-212(1973). (In German).

A multipurpose recording and measuring instrument is described for industrial isotopic measuring and control techniques (density, thickness, level, moisture) to which indicators, plotters and controllers can be connected. (GE)

## Radiation Effects on Instrument Components, Instruments, or Electronic Systems

*Refer also to abstracts 926 and 1028.*

**486** (AERE-R-7395) INVESTIGATION INTO CHANGES IN THE ELECTRICAL PROPERTIES OF THIN ANODIC OXIDE FILMS INDUCED BY ION IMPLANTATION. Suffield, N. W. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Jul 1973. 31p. Dep. NTIS (U.S. Sales Only) $3.75.

A study was made of the changes that could be induced in the electrical properties of a titanium/titanium dioxide/gold wafer by implanting the metal on which the oxide was to be grown with various ions. As it is difficult to obtain negative resistance cycling with $Ti/TiO_2/Au$ devices, $Al/Al_2O_3/Au$ devices which readily exhibit these electrical phenomena were also studied for comparison purposes. Oxide layers were grown anodically. The effect of an implantation was studied in terms of differences in the voltage/current characteristic as compared with that of an un-implanted device. (UK)

**487** (AI-65-TDR-179) HARDENING OF TRANSISTOR CIRCUITS TO IONIZING RADIATION. Crowe, J. W. (Atomics International, Canoga Park, Calif. (USA)). 10 Sep 1965. 13p. Dep. NTIS $3.00.

It is shown experimentally that transistor circuits may have their fundamental sensitivities to ionizing radiation reduced by factors of ten by addition of a simple reverse biased diode. Bipolar transistors, field effect transistors and microcircuits have been hardened. (auth)

**488** (SLA-73-708) DEPENDENCE OF CRYSTAL RESONATOR FREQUENCY ON ELASTIC AND DIELECTRIC LOSS. Holland, R. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jun 1973. 31p. Dep. NTIS $3.75.

If a crystal oscillator circuit is exposed to ionizing radiation, the output frequency usually exhibits a transient drop. This frequency drop may be quantitatively associated with a radiation-induced jump in the dielectric and elastic losses of the crystal. Mathematical formulas and graphical diagrams are presented here which permit understanding and prediction of these relationships. (auth)

**489** (SLA-73-5731) RADIATION EFFECTS ON MICROELECTRONICS. Gregory, B. L. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1973. 10p. (CONF-731024-1). Dep. NTIS $3.00.

From international society for hybrid microelectronics symposium; San Francisco, California, USA (22 Oct 1973).

The major effects of a nuclear radiation environment on microelectronics are reviewed, with emphasis on semiconductor devices and other radiation sensitive components. The neutron, ionization dose and transient radiation effects have been explored for a variety of typical devices. The radiation failure modes are identified for most classes of semiconductor circuit elements, and hardening techniques are reviewed. Estimates are made of current and ultimate hardness levels of semiconductor devices. (auth)

**490** INFLUENCE OF THE CHANNELING EFFECT ON THE LUMINESCENCE OF NaCl SINGLE CRYSTALS UNDER ION BOMBARDMENT. Schalch, D.; Scharmann, A. (Univ., Giessen, Ger.). Z. Phys.; 264: No. 1, 73-84(1973).

Channeling of 10- to 50-keV noble gas ions in NaCl single crystals was studied by measuring the luminescent response of crystals as a function of the angle of incidence with respect to ⟨100⟩, ⟨110⟩ axial, and (100) planar directions. Pronounced peaks could be detected if the ion beam was well aligned with low-index directions. A description of peak heights versus ion atomic number $Z_1$ was given in terms of nuclear and electronic stopping cross sections. The increase of luminescent response in channeling directions can be explained by the strong decrease of nuclear stopping that dominates the energy loss at low ion energies in amorphous targets and in random directions in crystals. An additional influence of the channeling effect on the mechanism of energy conversion is discussed. (GE)

**491** LOW-ENERGY ION BOMBARDMENT OF SILICON DIOXIDE FILMS ON SILICON. II. Inert Ambient Annealing of Degradation in MOS Devices. McCaughan, D. V.; Murphy, V. T. (Bell Telephone Labs., Murray Hill, NJ). J. Appl. Phys.; 44: No. 7, 3182-3190(Jul 1973).

It is shown that the degradation of the C−V properties of the $SiO_2/Si$ interface caused by low-energy ion bombardment may be completely removed by annealing to temperatures of 900°C or higher. The low-energy ion bombardment, however, also causes damage to the dielectric strength of the $SiO_2$. This damage only partially anneals out, even at the highest annealing temperatures. Annealing to temperatures between 400 and 600°C apparently removes all C−V damage, as measured at room temperature, but bias-temperature instabilities, which require the higher temperature for their removal, remain. Annealing of any oxide to temperatures in the range 700 to 850°C is not recommended, as it may introduce instabilities independent of ion bombardment. The same annealing procedure is required for 50, 500, and 1400 eV ion bombardment, leading to the conclusion that, in terms of ion bombardment damage, low-voltage sputtering gives no advantage over high-voltage sputtering. The dielectric breakdown damage is also independent of the ion energy in the range of 50 to 1500 V used in this study. It is concluded that since all dielectric breakdown damage is not annealable, a method of prevention of oxide charge buildup during backsputtering is essential if this technique is to be used on insulating substrates. Appropriate choice of rf backsputtering voltage as a function of the insulator film thickness can significantly reduce or eliminate the bulk dielectric degradation. (8 figures, 3 tables, 21 references) (auth)

## Miscellaneous Instruments

*Refer also to abstracts 250, 845, 917, 963, 1055, 1576, 2354, 2365, and 2404.*

**492** (ANL-8048) ROTATABLE EXTENDER FOR SERVICING ELECTRONIC EQUIPMENT EMPLOYING NUCLEAR INSTRUMENT MODULES. Sevec, J. B.; Stein, A. D. (Argonne National Lab., Ill. (USA)). Sep 1973. Contract W-31-109-eng-38. 5p. Dep. NTIS $4.00.

A modification of the extender rack for servicing Nuclear Instrument Modules is described. The modification allows the module under test to be rotated to a more accessible position. (auth)

**493** (BIPM-70-6) STUDY OF COUNTING TECHNIQUES USING CORRELATORS. Mueller, J. W. (Bureau International des Poids et Mesures, 92-Sevres (France)). 1970. 3p. (In French). Dep. NTIS (U. S. Sales Only) $3.00.

The possibilities offered by an experimental determination of correlation functions were studied in view of a possible use in $4\pi\beta$-$\gamma$ and other general counting techniques. The conditions of measurement and interpretation are especially suitable when the correlation is in relation with a random function with two values only, transitions being ordered by the pulses of the counting experimental process to be studied. Such a device is also quite suitable in an electronic setup where the two possible states, realized with a bistable, are triggered in accordance with the pulse registered by a counter. (FR)

**494** (IPP-9/10) DIGITAL CONTROL UNIT IN TTL LOGIC FOR AUTOMATIC EXECUTION OF AUGER AND ESCA TEST PROGRAMS. Zinser, J. (Max-Planck-Institut fuer Plasmaphysik, Garching/Munich (F. R. Germany)). May 1973. 33p. (In German). Dep. NTIS (U. S. Sales Only) $3.75.

A digital control unit in TTL logic for controlling various measuring facilities in an experimental setup was developed. This unit can be used on its own for control purposes or else in conjunction with a process control computer (ND 812). A detailed description of the various components of the unit is given together with a few typical examples of application. In particular, a test circuit for electron spectroscopy of Auger electrons and photoelectrons is described. The unit allows fully automatic execution of a test program. (auth)

**495** (LA-UR-73-884) COMPUTERIZED SYSTEM FOR ULTRALOW TEMPERATURE POLARIZED NUCLEI TIME REVERSAL AND PARITY EXPERIMENTS. Handy, L. E.; Steyert, W. A. (Los Alamos Scientific Lab., N. Mex. (USA)). 1973. 6p. (CONF-731101-8). Dep. NTIS $3.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum and Nuclear Energy Exhibition; San Francisco, California, USA (11 Nov 1973).

A system used for data acquisition, control, and analysis in polarized radioactive nuclei experiments is described. Experimental precision requires data accumulation over long periods of time, and a computer is used for data reduction while the experiment is in progress. (auth)

**496** (NBL-267, pp 96-99) CENTRAL ANNUNCIATOR PANEL FOR THE NEW BRUNSWICK LABORATORY: A PROGRESS REPORT. Hemmer, R. J. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

The various NBL alarm systems (fire, smoke, stack monitor, waste tank, differential pressure, gamma monitor, air monitor, stack flow, air pressure, and freeze) have been consolidated into one master panel in the main building with a repeater panel in the other building. The various alarms are given one of three priorities indicated by the color of the lighted display and by a distinct audio signal. The system has been in partial operation for several months. (auth)

**497** (RISO-M-1632) ELECTRONICS DEPARTMENT: ANNUAL REPORT, 1972. (Danish Atomic Energy Commission, Risoe. Research Establishment). Aug 1973. 37p. Dep. NTIS (U. S. Sales Only) $4.00.

Topics briefly discussed include determination of uranium and thorium by means of neutron activation analysis, aeroradiometric survey techniques, analysis of control tasks in a power plant unit, alarm presentation, methods for description of complex systems reliability, hybrid computer, research instrumentation, and laser technology. Lectures and publications are listed. (WHK)

**498** LABORATORNYE PRIBORY I ELEKTRONNYE BLOKI DLYA YADERNOFIZICHESKIKH ISSLEDOVANII. (Laboratory Instruments and Electronic Units for Nuclear Physical Studies). Levandovskii, E. A.; Skotnikov, V. I. Moscow; Atomizdat (1972). 103p.

This study lists electronic instruments primarily of USSR origin that are used in nuclear physics such as preamplifiers, amplifiers, discriminators, double coincidence counters, etc. Technical data are presented on the signal rise time, ratio between amplitudes of inlet and outlet signals, ratio between average count rate and final readings, integral non-linearity of characteristics, differential non-linearity, resolving time, limiting pulse load, maximum amplitude ratio of two signals at half width of the channel, level of amplifier noise, channel width, instability of the amplification factor, instability of the discrimination threshold, coincidence resolving time, stabilization coefficient on turning off and turning on the stabilization system, and the time constant of integration. Typical chassis dimensions are given. Some guides are given for maintaining and servicing electronic equipment. (SJR)

**499** ION SOURCE FOR VAPORIZING AND IONIZING SOLID SUBSTANCES. Brunnee, C.; Jenckel, L. (to Varian Mat GmbH). US Patent 3,758,777. 11 Sep 1973. Priority date 7 Jan 1969, F.R. Germany. 6p.

A high vacuum ion source for use with a mass spectrometer to analyze solid substances is described. A thermally conductive body having the substance to be analyzed supported on a surface thereof is disposed in the ionization chamber with the substance supporting surface facing the ionization region of the chamber. A heat source, such as an electron emitting device, is directed toward the opposite surface of the body to heat the body and cause the substance to vaporize. The heating of the body in turn heats the chamber surfaces to prevent condensation of the vaporized substance. The vaporized substance can be ionized by particle bombardment or field emission. The body may take the form of a flat plate or a cylindrical or other box-like structure. (19 claims, 6 drawing figures) (Official Gazette)

**500** X-RAY EMISSION SPECTROSCOPY. Parts 1 and 2. Valkovic, V. (Rice Univ., Houston TX). Contemp. Phys.; 14: No. 5, 415-462 (Sep 1973).

In part I of this article x-ray production by charged particle and x-ray excitation is described. Theory and experiments on charged-particle-induced x-ray emission are summarized. Detection of x-rays by semiconductor and other detectors are discussed. In part II of this article some applications of x-ray emission spectroscopy in industry, water and air pollution, and in the study of the importance of trace elements in biology and medicine are described. Sensitivity, background problems, target preparation and data reduction for x-ray emission spectroscopy are discussed. (UK)

# ISOTOPE AND RADIATION SOURCE TECHNOLOGY

## Isotope Separation (Industrial)

*Refer also to abstracts 1, 136, and 148.*

**501** (MLM-2068, pp 9) CARBON ISOTOPE SEPARATION. (Mound Lab., Miamisburg, Ohio (USA)). 22 Aug 1973.

In Mound Laboratory activities for the Division of Physical Research: January–June 1973.

**502** (MLM-2068, pp 10-11) STABLE ISOTOPE SEPARATION. (Mound Lab., Miamisburg, Ohio (USA)). 22 Aug 1973.

In Mound Laboratory activities for the Division of Physical Research: January–June 1973.

## Isotopic Power Sources

**503** (LA-UR-73-939) ANALYSIS OF INTERNAL PRESSURE BEHAVIOR AS A FUNCTION OF VENT SIZE IN A RADIOISOTOPIC THERMOELECTRIC GENERATOR. Travis, J. R.; Peterson, D. E.; Mulford, R. N. R. (Los Alamos Scientific Lab., N. Mex. (USA)). [nd]. Contract W-7405-eng-36. 7p. (CONF-731101-17). Dep. NTIS $3.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum and Nuclear Energy Exhibition; San Francisco, California, USA (11 Nov 1973).

A theoretical investigation was undertaken to determine the effect of acceptable cladding vent sizes on the internal oxygen pressure in a $PuO_2$ fuel sphere of a heat source capsule which consists of the fuel sphere clad in Ir metal. The results are to be used in the design of a radioisotope-fueled thermoelectric generator for space applications (SNAP). The vents must be large enough to minimize the oxygen pressure in the sphere, thereby minimizing the transport of Ir, and, at the same time, small enough to prevent the escape from the capsule of particulate Pu. The vent is idealized as a short tube of length l and radius a. The flow equations assume transitional viscous-molecular flow through such a short tube. The results indicate that a vent with a l/a ratio of 8 significantly improves the oxygen exhaust rate in the fuel capsules as compared to smaller vent sizes and should solve the problems resulting from the transport of iridium. (LCL)

## Radiation Sources

*Refer also to abstracts 470, 510, 783, and 1061.*

**504** CONTAINER FOR RADIOACTIVE SOURCE. Stein, S. (To National Research Development Corp.). German Patent 1,923,229. 19 Nov 1970. Filed date 7 May 1969. (In German)

A container for a radioactive source is described which has a baffle consisting of two parts that are movable in relation to each other between the opening and closing positions and a source holder that is surrounded by the baffle when it is in the closed position so that the previously mentioned baffle absorbs the radiation emitted by the source and directs the radiation in predetermined directions when the baffle is in the open position. (TSS)

**505** CONTAINER FOR NUCLEAR RADIATION SOURCES. Blaykovskii, K. M. (To Luganskii Filial Instituta Giproougleavtomatizatsi). Russian Patent 246,702. 22 Jan 1968. (In German).

A container for nuclear radiation sources is described that consists of a main part of which the cavity is filled with a material for biological protection, a collimation orifice, a cover to shut off the radiation flux with an operating element coming to the exterior across the biological shield and the main part and to ensure the working capacity and the air- and water-tightness of the receiver under conditions of fire and other conditions of damage when the ambient temperature of the medium exceeds the melting temperature of the biological shield. The operating element coming to the exterior across the biological shield and the main part is filled with a spring and a conical surface corresponding to the conical surface in the main part. It is supported on a limiter that prevents friction of the surfaces. The limiter material has a melting temperature less than the melting temperature of the biological shield. (TSS)

### Industrial Uses

*Refer also to abstracts 550–553, 598, and 605.*

**506** (IAEA-R-731-F) RADIATION SENSITIVITY OF THE MICROBIAL FLORA OF FRESH WHITE (LEAN) FISH. Final Report, 15 December 1968–14 December 1971. De La Sierra Serrano, D.; Del Real Gomez, G.; Perez Florez, F.; Saiz De Bustamante, M. C.; Alonso Rodriguez, M.; Matutano Aranda, J. I. (International Atomic Energy Agency, Vienna (Austria)). Mar 1972. 73p. (In Spanish). INIS.

Investigations were undertaken to determine the initial bacteriological contamination including eventual contamination with Clostridium botulinum, type E of 3 species of white fish: Merluccius merluccius (hake), Lepidorhombus boscii (dory), and Gadus morhua (codfish). Moreover, extension of the market life at the optimum radiation doses and physical factors including irradiation and storage temperatures and packaging were studied. Packaged fillets were gamma irradiated from cesium-137 source at various dose levels ranging from 50 to 300 Krad. Irradiation and post-irradiation storage were at 0 to 2°C. It was found that an irradiation dose of 50 to 100 Krad at an irradiation and storage temperature of 0 to 2°C resulted in 12 to 21 days' extension of storage life of packaged hake, codfish, and dory fillets. It was also found that no botulinus toxin was produced before the end of the commercial storage life of irradiated and control hake and codfish fillets inoculated with Clostridium botulinum, type E spores when storage was at a temperature of 3 to 4°C. (HLW)

**507** GAMMA-IRRADIATION APPARATUS FOR GRANULAR MATERIALS OF BIOLOGICAL ORIGIN. Kaushanskii, D. A.; Gurevich, Ya. A.; Zhukov, B. G.; Srapenyants, R. A.; Kalyanov, D. M. (to AN SSSR, Moscow, Inst. Organicheskoj Khimii). Canadian Patent 918,311. 2 Jan 1973. vp.

An apparatus for irradiating grain continuously with gamma radiation is described. The apparatus is compact and mobile. Jacketed gamma sources are arranged vertically around an inner irradiation chamber, down which the grain passes. In the center of the chamber is a vertical rotating shaft, at the top and bottom of which inverted conical shielding members are mounted. They, together with stationary conical shields, form a labyrinth, and serve both for shielding and as a charging and discharging device. At the bottom there is an adjustable conical damper to control the rate of flow of grain. The central portion of the shaft is hollow, and contains an additional gamma source. The apparatus is intended primarily for use in farming, to irradiate seeds before sowing. (CA)

**508** STATISTICS ON THE USE OF RADIATION IN JAPAN. Hoshasen Riyo Tokei; No. 1971, 1-29(1971).

The utilization of radioisotopes and radiation generators has advanced greatly in recent years in Japan. The variety of their usage is ever expanding. They are now used in large quantities in nondestructive inspection, food irradiation, radiation chemistry, sterilization of medical supplies, and life breeding. Reviewing the uses in Japan for the fiscal 1970(from April to March), the statistics are given in tables and figures on the following: the trends of enterprises, institutions, etc. utilizing radiations; the types of radiation sources and instruments; the methods and purposes of their utilization; the magnitudes of radiation doses; the amounts of radioactive wastes produced; and the training and education of radiation personnel. (JA)

**509** EXPOSURE FROM THE INDUSTRIAL USE OF RADIOACTIVE ISOTOPES IN NUCLEAR INSTRUMENTS AND LABELLING TECHNIQUES. Uchrin, G. (MTA Izotop Intezete, Budapest). Izotoptechnika; 16: No. 9, 521-533(Sep 1973). (In Hungarian).

A review on the industrial use of isotopes in Hungary is given; and the estimation of radiation exposure is discussed. (WHK)

# LIFE SCIENCES

*Refer also to abstracts 2361 and 2410.*

**510** (COO-2208-4) AVAILABLE SPACE FOR A TOTALLY IMPLANTABLE CARDIAC PROSTHESIS. Progress Report, April 1, 1973–July 31, 1973. Nose, Y. (Cleveland Clinic Foundation, Ohio (USA). Dept. of Artificial Organs). 1973. Contract AT(11-1)-2208. 56p. Dep. NTIS $5.00.

The goal of the present program is to define the spatial constraints of the body for a totally implantable radioisotope-powered cardiac prosthesis. The design is such that the prosthesis is compatible with both the human and the experimental animal, the calf. Most recent efforts were directed to the definition of the size and shape of the human thorax for implanting the blood pump. This was done by formulating a mathematical shape model from dimensions obtained from plastic molds made in the chest cavity of human cadavers. The shape model was used in conjunction with dimensions obtained from 100 chest radiographs of living humans to arrive at a statistical distribution of chest dimensions. The results are presented as scale drawings of the walls of the thorax as a function of the percent of the population having sizes smaller than the given curves. An effort is underway to define the natural heart boundaries in the chest to define soft tissue and vascular connections in the thorax. A parallel effort was to determine the anatomical and physiological tolerance of calves to implanted models of the thermal converter. Five calves were implanted with models, four have been sacrificed at 8 to 12 months after implantation, and one remains under observation. All calves were in good physical condition with the retroperitoneal infrarenal space appearing to be most feasible for implantation. (auth)

**511** (ORNL-4915) BIOLOGY DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1973. (Oak Ridge National Lab., Tenn. (USA)). Oct 1973. Contract W-7405-eng-26. 177p. Dep. NTIS $7.60.

Brief summaries are presented for research studies in the fields of biochemistry, cell physiology, genetics, immunology, and carcinogenesis during the year ending June 30, 1973. A list is included of publications that report major findings in the studies. (CH)

**512** MEDICAL RADIOLOGY. Introduction into the Physical, Technical, and Biological Fundamentals of Radiation Application in Medicine for Physicians and Medical Technicians. Fifth Edition. Schlungbaum, W. Berlin; De Gruyter (1973). 400p. (In German).

The textbook includes: electricity (fundamentals, units, measuring devices), general radiology (photon and particle radiation, radioactivity), radiometry (dosimetry, units, measuring devices), generation of x rays (x-ray tubes and apparatuses, switchboards) and of hard and ultra-hard radiation by cascade and Van de Graaff generators, and by linear and circular accelerators (betatron, cyclotron), devices for radiation application in medicine (with accessories), properties and application of high energy radiations (passage through matter, diffraction, interference, luminescence with application in radioscopy, detailed treatment of the fundamentals and of the various specific techniques of x-ray photography in numerous medical fields, furthermore: xeroradiography, biological effects of energetic radiations, radiation hazards and protection along with the relevant regulations, radiation therapy with soft, medium hard, hard, very hard, and ultra-hard x-ray and gamma radiation and with particle radiations, along with indication, planning and methods of registration), low energy radiation therapy (light and short-wave therapy, diathermy), finally the application of radionuclides in medical research and diagnosis for the examination of thyroid gland, kidneys, spleen, liver, pancreas, lungs, brain, placenta, of vitamin-B-12-metabolism, of blood and hemopoietic system, bone, salivary glands and stomach wall, malignant tumors, etc. All subjects are presented clearly, illustrated with good photographs of numerous apparatuses and accessories. As all specific subjects treated in the text are printed in bold faced types, they can easily be looked up. (GE)

## Radiation Effects on Biochemicals

*Refer also to abstracts 2378, 2384–2386, and 2388.*

**513** (ORO-4183-16) CHEMICAL EFFECTS OF IONIZING RADIATIONS ON THE INDIVIDUAL AMINO ACIDS WITHIN INTACT AND PURE PROTEIN MOLECULES. Annual Progress Report for the Period Beginning February 1, 1973. Friedberg, F. (Howard Univ., Washington, D. C. (USA). Dept. of Biochemistry). 30 Oct 1973. 8p. Dep. NTIS $3.00.

The addition of $Cd^{2+}$, $Ni^{2+}$, $Fe^{2+}$, or $Cu^{2+}$ had a protective effect against the radiolysis of proteins exposed to $\gamma$ rays. Addition of the ions to samples of gelatin, lathyntic collagen, and polyademylic acid effectively reduced the decrease in molecular weight observed following exposure to $\gamma$ rays. (ERB)

**514** (PRNC-170) POSSIBILITIES OF PARTIAL DAMAGE OF HORSERADISH PEROXIDASE MOLECULE BY MONOCHROMATIC X RADIATION. Rivera, J. P.; Paraskevoudakis, P. (Puerto Rico Nuclear Center, Mayaguez). Aug 1973. Contract AT(40-1)-1833. 46p. Dep. NTIS $4.50.

Thesis. Submitted by J. P. Rivera to Univ. of Puerto Rico, Mayaguez.

Aqueous solutions of horseradish peroxidase, a conjugated protein, were exposed to doses of x radiation ranging from 200 to 3300 rads, subsequently treated with heat at 68°C, and analyzed for inactivation, using the ability of the enzyme to decompose $H_2O_2$ as the test criteria. Results showed that the radiation damage spectrum of horseradish peroxidase is energy dependent in the photon energy range from 6.40 to 8.40 keV. This radiation damage is made manifest by heating at 68°C, which enhances the effect of the radiation. Modes of horseradish peroxidase inactivation are discussed and compared with those of catalose. (CH)

**515** MOLECULAR DEGRADATION AND REACTIVITY DETERIORATION OF FIBRINOGEN BY $^{60}$CO-IRRADIATION. Asahara, A. (Jikei Univ., Tokyo). Tokyo Jikeikai Ika Daigaku Zasshi; 87: No. 5, 874-884(Sep 1972). (In Japanese).

Thrombin was seldom affected by $^{60}$Co irradiation. On the other hand fibrinogen which was seldom changed in a crystal was markedly degraded by a small dose of radiation in a solution form; at the dose from 250 to 500 R, clotting time of blood was shortened and its viscosity reduced. At the dose over $10^3$R, clotting time was prolonged and the viscosity increases. In order to investigate molecular change of fibrinogen by a small dose of radiation from 250 to 500 R, measurement of ultraviolet spectrum and determination of SH radical were performed. Maximum ultraviolet absorption of neutral fibrinogen was obtained at 248m after $^{60}$Co irradiation, and it is in good agreement with that of 2-methylthiazoline. SH radical showed no change in about 80% during the initial radiation from 250 to 500 R, above which it was markedly decreased. Besides fibrinogen, the substances containing SH radical such as glutathion and albumin showed a peculiar absorption at 248mμ. Generally fibrinogen seems to have no SH, but the author realized that free SH radical was present in fibrinogen and related to formation of thiazoline circle following dehydration. It must be pointed out that SH radicals are not all concerned with the mechanism of thiazoline formation. It was concluded that the SH radicals will be divided into two groups according to whether they are damaged by irradiation or not. (auth)

**516** CORRELATION BETWEEN DEGRADATION, REPLICATION, AND REPAIR OF YEAST DNA IRRADIATED BY ULTRAVIOLET OR $\gamma$ RAYS. Hatzfeld, J. (Institut de Radium-Biologie, Orsay, France). Biochim. Biophys. Acta; 299: 43-53(23 Feb 1973).

After low doses of ionizing or ultraviolet irradiation, no DNA degradation is observed in yeast if the cells are incubated in saline buffer. In a medium that permits growth, degradation of up to 15% of the DNA is observed. This degradation does not occur during the post-irradiation time lag, but only during the first doubling of the whole culture. The resumption of growth, characterized by the onset of DNA synthesis, involves every cell, even those that will not form clones. For high doses, which result in very low cell survival, the kinetics follow a different pattern. Degradation begins immediately after ionizing or ultraviolet irradiation, it continues at a lower rate and to a lesser extent than for cultures irradiated at low doses. After ultraviolet irradiation, photoreactivating treatment markedly decreases the degradation observed after low doses. Contrary to the effects of ionizing radiation, degradation after ultraviolet irradiation appears to involve not only the DNA previously synthesized, but also the DNA neosynthesized after irradiation. It may be that, in this situation, the polymerase skips over every "tolerated" dimer, leaving a gap in the newly synthesized DNA strand, whereas after ionizing radiation the break already exists in the irradiated parent DNA. (auth)

**517** SEDIMENTATION OF DNA OF DICTYOSTELIUM DISCOIDEUM LYSED ON ALKALINE SUCROSE GRADIENTS. Role of Single Strand Breaks in Gamma Ray Lethality of Sensitive and Resistant Strains. Khoury, A. T.; Deering, R. A. (Pennsylvania State Univ., University Park). J. Mol. Biol.; 79: No. 2, 267-284(15 Sep 1973).

The nuclear and mitochondrial DNA of the amoebae of the cellular slime mold Dictyostelium discoideum were labeled with [methyl-$^3$H] thymidine by allowing them to grow on Escherichia coli 15T$^-$ containing this label in its DNA. Neutral CsCl gradients were used to identify the labeled molecules. Alkaline sucrose sedimentation profiles of cells lysed directly on the gradients revealed two high molecular weight species, one of about 90 S (single-strand mol wt = $1.4 \times 10^9$) identified by alkaline CsCl rebanding as nuclear DNA, and another of 43 S (single-strand mol wt = $2.3 \times 10^7$), identified as mitochondrial DNA. These gradients were used to study the production of single-strand breaks and their rejoining in DNA of a gamma-resistant strain (NC-4; 10% survival dose for cell proliferation, $D_{10}$ = 75 krad) and in two radiation-sensitive daughter mutants (ys-18, $D_{10}$ = 75 krad; ys-13, $D_{10}$ = 4 krad). With $^{60}$Co gamma rays, breaks were produced in nuclear and mitochondrial DNA at an efficiency of one break per 33 eV in all three strains. At doses up to about 100 krad, these single-strand breaks were closed equally well during post-irradiation incubation of NC-4, ys-18, and ys-13, even though their survivals were widely different, indicating no apparent correlation between parental strand rejoining and survival in the sensitive strains. At higher doses, post-irradiation treatment with 1 mg caffeine/ml sensitized NC-4 and retarded strand-rejoining, suggesting that lethality in this resistant strain may be related to strand breaks. Single-strand rejoining is considered a necessary, but not sufficient, condition for radiation survival in this organism. The nature of the apparently unrepaired lesions leading to lethality in the sensitive strains was not known. (auth)

518 IS THE ABILITY TO REPAIR DAMAGE TO DNA RELATED TO THE PROLIFERATIVE CAPACITY OF A CELL? The Rejoining of X-ray-produced Strand Breaks. Karran, P.; Ormerod, M. G. (Royal Cancer Hospital, Belmont, Eng.). Biochim. Biophys. Acta; 299: 54-64(23 Feb 1973).

Sedimentation in gradients of alkaline sucrose was used to observe the production and rejoining of x-ray-produced strand breaks in the DNA of cells from rats and chickens. The DNA was estimated by a fluorimetric method that permitted the study of non-dividing cells whose DNA could not be labelled with radioactive precursors. It was found that cells from the thymus or spleen of rats contain DNA of high molecular weight ($>10^9$) and can rejoin single-strand breaks introduced into DNA by x rays. This suggests that cells that are not synthesizing DNA possess at least one class of repair enzymes. Cells prepared from muscle of 1-day-old rats contain high molecular weight DNA and can rejoin single-strand breaks. Muscle cells prepared from older animals (1 week or older) contain DNA of lower molecular weight and cannot rejoin strand breaks. This could be the result of the preparative procedure and not reflect the situation in vivo. Newly formed chicken erythrocytes contain DNA of high molecular weight but cannot rejoin strand breaks. As the cells age in vivo, the molecular weight of the DNA decreases to about $2 \cdot 10^8$. This demonstrates that at least one type of post-mitotic cell does not possess repair enzymes. (auth)

519 REPAIR DEFECT MUTANTS OF PROTEUS MIRABILIS. II. Excision of Pyrimidine Dimers from the DNA of Ultraviolet-Irradiated P. Mirabilis Wild-Type and UV-Sensitive Mutants. Stoerl, K.; Mund, C.; Venner, H. (Deutsche Akademie der Wissenschaften, Berlin). Mol. Gen. Genet.; 124: No. 3, 259-268 (1973).

Two photoproducts, thymine-thymine and cytosine-thymine dimers were identified after uv irradiation of Proteus mirabilis. It was found that 1 erg/mm$^2$ at 253 nm produced approximately $2.9 \times 10^{-6}$ pyrimidine dimers/thymine residues or about 8 dimers per $10^7$ nucleotides. Both photoproducts were excised at the same rate from the DNA of ultraviolet-resistant wild-type cells (PG 273, PG 758), but remained in acid precipitable DNA in ultraviolet-sensitive HCR-mutants (PG 678, PG 686). The excised dimers appeared both in the TCA-soluble cell fraction and in the medium outside the cells. EXR-mutants (PG 693, PG 699) also demonstrated excision capability. The excision ability of the REC-mutant (PG 672) could not be unambiguously demonstrated, because of high DNA-degradation. The number of excised dimers depended on the uv dose. In contrast to HCR-mutants of Escherichia coli, HCR-mutants of P. mirabilis showed DNA-degradation at about the same rate as the wild-type strain during repair after uv irradiation. (auth)

520 METHOD FOR DETECTING PYRIMIDINE DIMERS IN THE DNA OF BACTERIA IRRADIATED WITH LOW DOSES OF ULTRAVIOLET LIGHT. Ganesan, A. K. (Stanford Univ., CA). Proc. Nat. Acad. Sci. U. S. A.; 70: No. 10, 2753-2756(Oct 1973).

Cells of Escherichia coli treated with lysozyme and Brij-58 become permeable to proteins, but do not release their DNA. Permeable cells were incubated with an endonuclease that produces single-strand breaks in DNA-containing pyrimidine dimers. The enzyme entered the permeable cells, and, if they had been irradiated with uv light, caused breaks in their DNA. The frequency of breaks was estimated from the sedimentation pattern of the DNA in alkaline sucrose gradients. The procedure is sensitive enough to detect the dimers produced by a dose of 10 erg/mm$^2$ at 254 nm, or about 50 dimers per E. coli genome. This method exemplifies and extends the use of permeabilized cells for examining biological processes at the molecular level. (auth)

521 EFFECT OF BERBERINE ON THE YIELD OF PYRIMIDINE DIMERS IN UV-IRRADIATED DNA. Klimek, M.; Sevcikova, P.; Pidra, M. (Inst. of Biophysics, Brno). Stud. Biophys.; 36-37: 37-42(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

The effect of berberine on the yield of thymine dimers produced by uv light in DNA isolated from mouse leukemic cells and in DNA within irradiated cells was investigated. In solutions of isolated DNA the complete inhibition of thymine dimerization was found at the concentration of berberine equal to $2 \times 10^{-3}$M. However, in the cells inhibition of dimerization by berberine was never complete. In L cells a pronounced decrease in the intensity of DNA synthesis was found in cells treated with berberine, dependent on berberine concentration used. But despite the presence of berberine in cell nuclei, no inhibition of pyrimidine dimerization in uv irradiated cells could be established. (auth)

522 INDEX OF IN VITRO SENSITIVITY TO X-RAYS OF ENDOLYMPHOCYTIC GLYCOGEN. Micu, D.; Roxin, T.; Pogaceanu, P. J. Inst. Nucl. Eng.; 14: No. 3, 80-81(May 1973).

In 21 patients with diseases such as chronic lymphocytic leukemia, acute lymphocytic leukemia, lymphosarcoma, and Hodgkin's disease, and in 10 normal subjects, a sensitivity test in vitro to an irradiation dose of 50 r to the peripheral blood lymphocytes was performed. The lymphocytic glycogen score was determined before and after irradiation. The index of sensitivity to x rays was established, dividing the score found after irradiation by the initial score. In the normal controls the index thus calculated was 56 ± 0.17. In the patients this index was close to the normal values in the periods of sensitivity to treatment, while in the periods of resistance to the therapy administered the index reached high values ranging from 0.92 ± 0.13 to 0.13 ± 0.28. The practical importance of this test in the choice of therapy and follow-up of results is emphasized. (auth)

523 INACTIVATION OF TRANSFORMING ACTIVITY OF DNA AFTER X IRRADIATION IN AQUEOUS SOLUTION. Hartwig, M.; Grunow, R. (Central Institute for Molecular Biology, Berlin). Stud. Biophys.; 38: No. 1, 41-44(1973). (In German).

The inactivation of transforming activity of x-irradiated Bacillus subtilis DNA varied in different preparations up to three potencies. It is demonstrated that different mean single-strand lengths of unirradiated DNA molecules and different sensitivities of the DNA to physicochemically measurable lesions, induced by radiation, are responsible for this effect. (auth)

524 MODIFICATION OF SERUM SCN AND OF TISSUE RHODANESE AFTER IRRADIATION OF RATS. Stanculescu, V.; Ciubotaru-Bordeianu, A.; Iliescu, M. (Inst. of Hygiene and Public Health, Bucharest). Rev. Roum. Biochim.; 10: No. 1, 61-67(1973).

Experiments performed on white rats showed that a variation of the concentration of the thiocyanate in the serum and in the salivary glands appears one day after x irradiation of the animals. This variation is more marked in the range of small doses, and the dose-dependence curves are similar in the two media investigated. After a single exposure, an increase is observed in the first days in the thiocyanate which is followed-up for seven days, after which its concentration registers a fall. The enzymatic activity of liver and kidney rhodanese shows a decreasing tendency with increasing exposure of animals, and in time the activity of the rhodanese is consistently diminished towards the end of the experimental period. (auth)

525 STUDY OF THE EFFECT OF ULTRAVIOLET LIGHT ON BIOMEMBRANES. II. Action of Irradiation on Chemiluminescence in Mitochondria Suspensions. Marzoev, A. I.; Roshchupkin, D. I.; Vladimirov, Yu. A. (Moscow Medical Inst.). Biofizika; 18: No. 2, 258-263(1973). (In Russian).

When suspensions of mitochondria are irradiated in the presence of oxygen, they exhibit the afterglow as a result of a recombination of protein peroxide radicals. In such specimens a short flash of chemiluminescence was observed upon addition of Fe$^{2+}$. As demonstrated with the extraction experiments this type of glow was generated in membrane lipids. UV irradiation also stimulates subsequent development of the slow flash of chemiluminescence (the induction period is reduced), which appears in the course of $Fe^{2+}$-activated oxidation of lipids. The mechanism that accounts for this effect is the formation of lipid photoperoxides and (or) the inactivation of the mitochondria antioxidants. The biological importance of the photochemical reactions in lipid is discussed. (auth)

**526** PHOTOCHEMISTRY OF SOME ANOMALOUS NUCLEIC ACID BASES. Deviations from the Photochemical Behavior of the Normal Constituents. Kittler, L.; Loeber, G. (Zentralinstitut fuer Mikrobiologie und Experimentelle Therapie, Jena, Ger.). Stud. Biophys.; 36-37: 5-19(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Anomalous nucleic acid bases from azatype are biochemically important. They interfere with nucleic acid and/or enzyme-directed processes. To verify the reported results about the photobiological behavior of microorganisms supplemented with azabases, the available photochemical data are presented. The findings indicate deviations from the natural bases. It was shown that survival curves of different bacteria treated with the aza-compounds reflect the order of their photochemical stability. The correlation found between the photochemical and photobiological behavior of aza-analogues and the observed deviations in their uv-sensitivity relative to the natural bases opens a way to some new genetic studies. Thus it should be possible to incorporate anomalous bases with increased uv-sensitivity into certain genes of synchronized cells. Through irradiation, defects can be produced mainly in that part of a chromosome where the azabases are located. (auth)

**527** MECHANISM OF GLUTAMATE DEHYDROGENASE PROTECTION BY MEXAMINE DURING GAMMA IRRADIATION. Noskin, L. A.; Sverdlov, A. G.; Fomichev, V. N. (Inst. of Nuclear Physics, Leningrad). Dokl. Akad. Nauk SSSR; 211: No. 3, 733-736 (21 Jul 1973). (In Russian).

The inactivation of glutaminedehydrogenase (GDH) by gamma irradiation depended exponentially on the radiation dose in the range studied (0-2 Mrads), and inversely on the enzyme concentration. The addition of mexamine to GDH before irradiation had a protective effect. Results of the experiment cannot be explained by the presence of a third factor since the saturating concentration of mexamine was directly proportional to the enzyme concentration. Rather, the mexamine is probably bound to the GDH and has an affinity for one type of radical formed in radiolysis of water. (TTT)

**528** EFFECTS OF GAMMA IRRADIATION ON THE STRUCTURES AND REACTIVITY OF NATIVE AND CROSS-LINKED COLLAGEN FIBERS. Grant, R. A.; Cox, R. W.; Kent, C. M. (Agricultural Research Council, Cambridge, Eng.). J. Anat.; 115: No. 1, 29-43(May 1973).

Native and crosslinked rat tail tendon collagen were subjected to γ radiation up to a maximum dose of $100 \times 10^4$ J $kg^{-1}$ (100 Mrd). Collagen irradiated dry showed greater structural damage than that irradiated in the presence of water when examined in the electron microscope using negative staining techniques. Glutaraldehyde crosslinked collagen showed much less damage than native collagen, the fibrous form being retained even at the highest dose levels, although the band structure was profoundly altered. Wet- but not dry-irradiated collagen became resistant to the action of bacterial collagenase, while both wet- and dry-irradiated specimens were digested with elastase. Crosslinked collagen, normally resistant to both elastase and collagenase, became sensitive after varying doses of radiation, with marked differences in behavior between the wet- and dry-irradiated specimens. Gamma-irradiated collagen reacted abnormally with various histological stains and at the highest dose levels tended to resemble elastin in tinctorial properties. The crosslinked collagen showed less change than the native collagen. No marked changes were found in the amino acid composition of the irradiated collagen. Solubilities in hot alkali, cold acetic acid, and hot water were all decreased after irradiation of collagen in the wet state and increased after irradiation in the dry state. It was concluded that γ irradiation of collagen in the dry state results in scission of the polypeptide chains and that, in the presence of water, this is accompanied by the formation of intermolecular bonds. These processes appear to be accompanied by changes in the configuration of the polypeptide chains. (auth)

**529** STRUCTURAL STUDIES ON DNA USING TWO SINGLE-STRAND SPECIFIC NUCLEASES FROM NEUROSPORA CRASSA. Kato, A. C. Montreal, Quebec; McGill Univ. (1972). National Library of Canada, Ottawa.

Thesis (Ph. D.).

An exonuclease and an endonuclease from N. crassa, highly specific for single-stranded nucleic acids, were used in structural studies on DNA. The exonuclease was used in the identification of repetitive sequences in E. coli DNA. Sheared, denatured E. coli DNA was annealed at 60°C at a $C_0t$ of 1 and treated with the exonuclease. Approximately 8% of the DNA was recovered as renatured, double-stranded DNA by chromatography on methylated albumin kieselguhr. This DNA was denatured a second time and annealed at various $C_0t$ values; about 40% (3% of the starting material) reassociated at rates faster than the total DNA indicating that a small portion of the E. coli genome comprises a heterogeneous collection of repetitive sequences. The endonuclease nicked UV-irradiated native DNA faster than unirradiated DNA; increasing doses of UV resulted in an increase in the nucleolytic activity. These results suggest that the endonuclease may be involved in an excision-repair process. Superhelical RF I DNA was more sensitive to the action of the endonuclease than nonsuperhelical DNA suggesting that single-stranded regions may occur in superhelical DNA. The effects of UV-irradiation on superhelical DNA were also studied. The results of this investigation support the theory that superhelical DNA contains negative twists. (auth)

## Radiation Effects on Cells

*Refer also to abstracts 507, 632, and 2409.*

**530** (CONF-730941-1) CALCULATIONS RELATED TO THE APPLICATION OF NEUTRONS, PROTONS, NEGATIVELY CHARGED PIONS, AND HEAVY IONS IN CANCER RADIOTHERAPY. Alsmiller, R. G. Jr. (Oak Ridge National Lab., Tenn. (USA)). 1973. 56p. Dep. NTIS $5.00.

From grantees conference on instrumentation technology; Washington, District of Columbia, USA (25 Sep 1973).

The most significant aspects of the research conducted during the period from September 1, 1972 to August 31, 1973 on the comparative study of the use of photons, neutrons, protons, negatively charged pions, and heavy ions in cancer radiotherapy are reviewed. The survival of cultured cells was used as the test criteria. Calculations were made of radiation dose distributions in tissue-equivalent phantoms exposed to charged pions. (CH)

**531** (UCSF-10-P-2-X-1) HUMAN DISEASES WITH GENETICALLY ALTERED DNA REPAIR PROCESSES. Cleaver, J. E.; Bootsma, D.; Friedberg, E. (California Univ., San Francisco (USA). Lab. of Radiobiology). 1973. Contract AT(11-1)-Gen-10. 20p. (CONF-730829-2). Dep. NTIS $3.00.

From thirteenth international congress of genetics; Berkeley, California (20 Aug 1973).

Repair of single-strand breaks (produced by x radiation) in DNA and of base damage (produced by uv light) are two repair mechanisms that most mammalian cells possess. Genetic defects in these repair mechanisms are exemplified by cells from the human premature aging disease, progeria, which fail to rejoin single-strand breaks, and the skin disease, xeroderma pigmentosum (XP), which exhibits high actinic carcinogenesis and involves failure to repair base damage. In terms of the response of XP cells, many chemical carcinogens can be classified as either x-ray-like (i.e., they cause damage that XP cells can repair) or uv-like (i.e., they cause damage that XP cells cannot repair). The first group contains some of the more strongly carcinogenic chemicals (e.g., alkylating agents). Xeroderma pigmentosum occurs in at least two clinical forms, and somatic cell hybridization indicates at least three complementation groups. In order to identify cell lines from various different laboratories unambiguously, a modified nomenclature of XP lines is proposed. (auth)

**532** INTERFERON INDUCTION BY RICE DWARF VIRUS RNA. Antiviral Activity In Vitro and Its Stability. Takehara, M.; Suzuki, N. (Kobe Univ., Japan). Arch. Gesam. Virusforsch.; 40: 291-299(1973).

Interferon (IF) induction by rice dwarf virus RNA (RDV-RNA) was studied in comparison with that by poly I:C. The IF inducing capacities of both were approximately equivalent in rabbit kidney cells at the same concentration. Interferon was also induced by purified RDV virions. However, IF production by RDV was generally lower than by RDV-RNA. It was observed that marked differences exist in IF response of several species of cells to RDV-RNA. Highest titer of IF was obtained in rabbit kidney cells. The IF inducing capacity of RDV-RNA was shown to be more resistant to RN-ase and UV-irradiation as compared to poly I:C. Treatment of RDV-RNA at 60°C for 15 minutes did not alter its IF inducing capacity while poly I:C lost 50% of the activity. (auth)

**533** EFFECT OF HEAVY WATER ON THE MEMBRANE RESTING POTENTIAL OF NEURONS IN CULTURE. Wan, C. C. London; Univ. of Western Ontario (1972). National Library of Canada, Ottawa.

Thesis (Ph. D.).

Changes in the membrane resting potential of embryonic neurons as $D_2O$ replaced $H_2O$ in the culture medium were investigated. These results were used to develop an explanation for the sympathomimetic effect observed in organisms fed deuterated diets. Chick dorsal root ganglia (CDRG) from ten-day old chick embryos were cultured for up to four weeks by the well established Maximow double coverslip lying drop method. All cultures were grown in a medium composed of Eagle's MEM, human placental serum, chick embryo extract, glucose and cortisone. An experimental set-up was designed to allow simultaneous optical observations and electrophysiological measurements of the neuron. Resting membrane potential values were obtained by impaling the neuronal soma with 3M KCl filled glass microelectrodes. The magnitude of the membrane resting potential appears to increase with the in vitro age of the control neurons from 34.3 mV for the 7-day old cultures to 44.7 mV for the 21-day old cultures. For the deuterated neurons, the membrane potential seemingly decreases from 32.0 mV for the 9-day old cultures to 27.7 mV for the 21-day old cultures. Once the neuron is mature, the membrane potential remained constant. This observation lends support to the hypothesis that the membrane potential is a functional correlate of the final differentiated state of the neurons. A frequency distribution analysis, utilizing a 1 mV interval was carried out to test the homogeneity of the population of neurons. Action potentials were noted in neurons older than three weeks in vitro. Three postulates for the mechanism of the $D_2O$ effect were considered. Theoretical calculations of the change of the internal $K^+$ concentration or $K^+$ permeability required to account for the observed change in the membrane potential helped to select the most likely mechanism. It is proposed that $D_2O$ acts as a denaturant either on the protein molecules in the membrane layer or on the cytoplasmic $H_2O$ molecules. (Diss. Abstr.)

**534** RESPONSE OF MOUSE HAEMOPOIETIC COLONY FORMERS TO ACUTE OR CONTINUOUS GAMMA IRRADIATION. Testa, N. G.; Hendry, J. H.; Lajtha, L. G. (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Biomedicine; 19: No. 5, 183-186(May 1973).

The effect of single doses of $^{137}Cs$ $\gamma$ rays or continuous $^{60}Co$ $\gamma$ rays on mouse hemopoietic colony-forming units (CFU) was investigated using both the in vivo spleen colony assay technique ($CFU_s$) and the in vitro colony assay technique ($CFU_c$). The difference in the respective $D_0$ slopes was maintained during continuous irradiation. At the dose rate used (3.2 rad/hr) the shoulder on the $CFU_s$ survival curve was abolished as expected, but the slopes of the early portions of the survival curves for both $CFU_s$ and $CFU_c$ were similar to those obtained after acute irradiation (600 rad/min). A $CFU_c$ subpopulation, which appears after adding red blood cells to the culture, showed a similar acute radiosensitivity to the whole $CFU_c$ population but was less depleted under continuous irradiation. The results are discussed in relation to the kinetics of progenitor hemopoietic cell populations after a single, or during a prolonged, stress. (FR)

**535** PROTEIN SYNTHESIS IN GIANT CELLS INDUCED BY X IRRADIATION. Megumi, T.; Hosokawa, Y. Annu. Rep. Radiat. Center Osaka Prefect.; 13: 124-127(1972).

L cells became giant without cell division after x irradiation with 5000 R and some of them reached 200 times volume of an unirradiated cell. Protein of giant cells was analyzed electrophoretically after treatment with SDS and urea. Electrophoresis of whole polypeptides of giant cells labeled with $^3H$-leucine and unirradiated cells labeled with $^{14}C$-leucine was performed in 8% of acrylamide gel. The electrophoretic pattern showed 13 bands at least. Incorporation of $^3H$-leucine in giant cells was remarkably less than that of $^{14}C$-leucine in unirradiated cells in band 6, 9, 10, and 11. Relationship with abnormality of protein synthesis, damage of cell division, and giant cell formation was discussed. (auth)

**536** BIOLOGICAL EFFECTS OF CORYNEBACTERIUM PARVUM. IV. Adjuvant and Inhibitory Activities on B Lymphocytes. Howard, J. G.; Christie, G. H.; Scott, M. T. (Wellcome Research Labs., Beckenham, Eng.). Cell. Immunol.; 7: 290-301 (May 1973).

The PFC response to the thymus-independent antigen SIII (type 3 pneumococcal polysaccharide) was amplified in mice injected 4 days previously with killed Corynebacterium parvum. This adjuvant activity was demonstrable with high (2 to 50 μg) but not low (0.1 to 0.5 μg) doses of SIII. Induction of tolerance was unaffected. Depression of the response resulted from simultaneous injection of SIII with either C. parvum or Bordetella pertussis, while prior treatment with the latter was without effect. Responsiveness to SIII was transiently but potently suppressed in spleen cells transferred into lethally irradiated, C. parvum pretreated mice. Although C. parvum is an effective B cell adjuvant, other data imply that it acts indirectly on these lymphocytes. It is argued that both adjuvant and suppressive activities of C. parvum on the B cell response to SIII are most probably mediated by activated macrophages. (auth)

**537** IN VITRO SENSITIZATION TO TRANSPLANTATION ANTIGENS. VI. Inhibition of Sensitization. Dyminski, J. W.; Argyris, B. F. (Syracuse Univ., NY). Cell. Immunol.; 7: 198-204(1973).

It was previously reported that C57BL/6 lymph node cells cultured with C3H/He macrophage monolayers are subsequently able to transfer specific allograft immunity to recipient C57 mice. The present communication is an investigation of the requirement for the functional integrity of cells to mediate allosensitization in vitro and to transfer allograft immunity. Results indicate that C3H macrophage monolayers subjected to x irradiation, actinomycin D, or antimacrophage serum pretreatment can no longer sensitize C57 lymph node cells in vitro: supernatants of C3H macrophage cultures do not substitute for monolayered cells and cannot sensitize C57 lymph node cells. Data also indicate that the integrity of the lymph node cells is required after sensitization in vitro: x-irradiated or sonicated allosensitized lymph node cells do not enable recipient mice to accelerate C3H allograft rejection. The results suggest that intact, functionally normal cells are required to sensitize, and to transfer allosensitization. (auth)

**538** CROSS-SENSITIVITIES TO UV LIGHT AND X RAYS OF TWO STRAINS OF MURINE LYMPHOMA L 5178Y CELLS IN VITRO. Beer, J. Z.; Szumiel, I.; Walicka, M. (Inst. of Nuclear Research, Warsaw). Stud. Biophys.; 36-37: 175-182 (1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Uv-light (254 nm) and 200 kv x-ray dose–survival relationships were determined for two strains of murine leukaemic lymphoblasts L 5178Y. Mean lethal doses were 54 erg. $mm^{-2}$ and 100 rads for L 5178Y-R cells, and 85 erg. $mm^{-2}$ and 54 rads for L 5178Y-S cells. Split dose experiments showed that dose fractionation produces sparing effects for uv-exposed L 5178Y-S cells and for x-irradiated L 5178Y-R cells. Dose fractionation caused marked reduction of relative survivals in the case of uv-exposed L 5178Y-R cells and x-irradiated L 5178Y-S cells. (auth)

**539** UV LIGHT AS A STIMULATING FACTOR FOR GROWTH OF MURINE LYMPHOMA L 5178Y CELLS IN VITRO. Walicka, M.; Beer, J. Z. (Inst. of Nuclear Research, Warsaw). Stud. Biophys.; 36-37: 165-173(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Cultures of L 5178Y-S and L 5178Y-R cells were exposed to various doses of 254 nm uv light, ranging from 11 to 535 erg. $mm^{-2}$. Growth of irradiated cultures was followed for up to 70 days after irradiation. UV exposure stimulated growth of about 70% of the irradiated cultures. The stimulation of ten appeared immediately after the post-irradiation growth disturbances and lasted from a dozen to several tens of generations. Proliferative activity was enhanced more for L 5178Y-R strain: maximal mean doubling time shortening for this strain was 43% whereas it was 20% for L 5178Y-S cells. It was demonstrated that the stimulation phenomena can occur also at later stages of the post-exposure development. (auth)

**540** BIOCHEMICAL MANIFESTATIONS OF RADIATION INDUCED DAMAGE IN CULTURED MAMMALIAN CELLS. Arlett, C. F.; Lehmann, A. R. (Univ. of Sussex, Brighton, Eng.). Stud. Biophys.; 36-37: 157-163(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

The pyrimidine dimer is believed to be the most important DNA lesion following treatment of bacteria with uv light. With mammalian cells, however, there is in general little correlation between cell survival and the ability to excise dimers from DNA. The correlation is also weak between unscheduled DNA synthesis or repair replication and cell survival. Post-replication repair or "gap filling" is an efficient repair mechanism, which may be present in all mammalian cells. In Chinese hamster cells, two uv-sensitive lines have efficient post-replication repair capabilities, but in one of them post-replication repair is slower than in the wild type. (auth)

**541** SUBCLONES DIFFERING IN SENSITIVITY TO ULTRAVIOLET RADIATION INDUCED IN AND SELECTED FROM HeLa S3 CELLS. Klimek, M.; Sevcikova, P.; Vlasinova, M.; Oltova, A. (Inst. of Biophysics, Brno). Stud. Biophys.; 36-37: 149-156 (1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Subclones of the clone of HeLa S3 cells were obtained; many of them are more sensitive than the original clone. Two resistant subclones were isolated. These resistant strains were found as hyperpentaploid subclones. It was demonstrated that in the postirradiation period the DNA synthesis in uv-irradiated sensitive mutant recovered more slowly from inhibition following irradiation and in a lower extent than in the case of irradiated cells of the original clone. DNA synthesis in resistant cells attained high values relatively soon after irradiation. DNA-repair of three clones (one of them was uv-sensitive, the second was uv-resistant and the third one was the original clone) was investigated using the BrdU-photolysis technique in connection with the centrifugation in alkaline sucrose gradient. The profiles of the DNA from the uv irradiated resistant strain were very different from those of the original HeLa S3 clone, but the sedimentation profiles of the uv-irradiated sensitive subclone was very close to that of the original clone HeLa S3. (auth)

**542** MUTAGENESIS IN CULTURED MAMMALIAN CELLS. Arlett, C. F. (Univ. of Sussex, Brighton, Eng.). Stud. Biophys.; 36-37: 139-147(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Variants of cultured mammalian cells may be obtained either by establishing cell lines from individuals with recognized metabolic disorders or by the selection of new phenotypes in existing cell lines. A range of drug-resistant or auxotrophic lines was obtained by selection from a number of different species. The induction of variant clones requires that selective techniques are available. The 8-azaguanine resistance in Chinese hamster V79 cells satisfies this requirement. This system may be used to detect mutation induction by the photosensitizing reaction on cells between 8-methoxypsoralen and 360 nm uv light. The availability of two uv-sensitive lines derived from the V79 cell line makes it possible to test the more general application of the repair model of mutagenesis in bacteria to mammalian cells. (auth)

**543** CELL CYCLE DEPENDENT EFFECTS OF ULTRAVIOLET LIGHT IN MAMMALIAN CELLS. Han, A. (Central Inst. for Tumours and Allied Diseases, Zagreb). Stud. Biophys.; 36-37: 127-137(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Cell cycle studies on mammalian cells are reviewed. Studies on cell survival in synchronized cells showed that DNA synthesis was not responsible for the peak sensitivity in the cell cycle and the resistance that occurred at the end of the cycle developed only if DNA synthesis had proceeded for at least part of S. UV-induced DNA-to-protein crosslinking was demonstrated in murine lymphoma and HeLa cells. Results gave no indication of how this damage was related to cell killing. The enhanced DNA-to-protein crosslinking in BUdR treated cells suggested that this kind of damage could play a role in uv-induced lethality. (HLW)

**544** COMPARISON OF THE EFFECT OF ACRIDINE DERIVATIVES AND SIMILAR SUBSTANCES ON THE DIMERIZATION OF THYMINE IN MAMMALIAN DNA IN SITU AND ISOLATED. Klimek, M.; Shevchikova, P. (Inst. of Biophysics, Brno). Stud. Biophys.; 36-37: 205-208(1973). (In Russian).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

If the cells were exposed to the effect of varying concentrations of proflavine, acridine orange, riboflavine, and methyl green before uv irradiation, the most effective of these substances was proflavine, which reduced the yield of dimerization in vivo by 50%. The other substances were much less effective and accounted for a maximum 20% decrease of the dimer yield. The different results in the thymidine dimerization rate, obtained with isolated DNA and DNA in situ, are discussed. (auth)

**545** REPAIR OF UV-DAMAGED DNA IN NORMAL HUMAN AND XERODERMA PIGMENTOSUM CELLS. Kleijer, W. J. (Medical Faculty, Rotterdam); de Weerd-Kastelein, E. A.; Lohman, P. H. M.; Bootsma, D. Stud. Biophys.; 36-37: 375-386(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

A review is presented of studies on repair processes in uv-damaged DNA of normal and xeroderma pigmentosum cells. Topics discussed are: unscheduled DNA synthesis and repair replication in xeroderma pigmentosum cells; genetic heterogeneity of xeroderma pigmentosum by somatic cell hybridization; and photoreactivation, recombination repair, and excision repair of DNA. (HLW)

**546** RADIATION INJURIES OF LYMPHOCYTES. Special Reference to Mechanism of Interphase Death. Oyama, H. (National Inst. of Radiological Sciences, Chiba, Japan). Hoshasen Kagaku; 15: No. 10, 5-12(Oct 1972). (In Japanese).

Low-dose irradiation with 25 R of x radiation induces cell death in the lymphatic system and almost all cells die with 600 R of x irradiation. Radioinduced cell death in lymphocytes is considered to be due to interphase death or reproductive death. The theory that reproductive death is caused by radioinduced damage of DNA is not proved yet. ATP, which is an energy source of living cells, is considered to play an important role in energy metabolism. Therefore, radioinduced metabolic damage causes functional injuries of cells which lead to interphase death of the cell. With radioinduced decrease of ATP level, increase of ADP and AMP is observed in cells such as liver cells, which is thought to be due to decrease of the level of total adenine nucleotides. It is suggested that ATP energy is accumulated in the form of fructose-1, 6-diphosphate after radiation damage of phosphofructokinase, and degradation of adenine nucleotides increases with decrease of ATP, which leads to cell death due to functional damage in metabolism in which ATP is involved. (auth)

## Radiation Effects on Microorganisms

*Refer also to abstracts 70, 506, 516, 517, 519, 520, 678, 2360, and 2373–2376.*

**547** EFFECT OF ULTRAVIOLET INDUCTION ON PHAGE RELEASE BY NOCARDIA ASTEROIDES. Pietkiewicz, D.; Andrzejewski, J. Med. Dosw. Mikrobiol.; 25: 171-175(1973). (In Polish).

Active phage was released from 6 strains of Nocardia asteroides, out of the 12 irradiated with uv. Two strains failed to release phage after uv treatment, even though previously they showed spontaneous release. It seems probable that they are not lysogenic but so-called carriers. None of the phages released was specific for a group of 4 strains which could not be typed hitherto. (auth)

**548** ULTRAVIOLET EFFECTS ON BIOLOGICAL FUNCTION OF RNA PHAGE MS2. Yamade, Y.; Shigeta, A.; Nozu, K. (Osaka Univ.). Biochim. Biophys. Acta; 299: 121-135(23 Feb 1973).

Ultraviolet effects on the biological function of MS2 phage were investigated. The adsorption of MS2 phage to the host cells is not affected by ultraviolet irradiation of the phage, but the penetration of phage RNA is reduced. Hydrated uridine was detected in the RNA molecules of ultraviolet-irradiated MS2 phage. The sedimentation patterns of the parental phage RNA molecules extracted from Escherichia coli at 12 min after infection with ultraviolet-irradiated phage are heterogeneous in size. However, ribonuclease-resistant RNA duplex (RF) detectable in cells infected with non-irradiated MS2 phage is not found in these cells. The phase RNA in the cells infected by ultraviolet-irradiated MS2 phage is fragmented into small size molecules even when the infected cells were incubated with chloramphenicol; no degradation of parental phage RNA is observed in cells infected with non-irradiated MS2 phage under the same conditions. Ultraviolet-irradiated MS2 phage also might be able to induce an RNA replicating enzyme (RNA replicase) in the host cells, although the enzymic activity seems to be lower than that induced in the cells infected with non-irradiated MS2 phage. (auth)

**549** IMMEDIATE EFFECT OF GAMMA-IRRADIATION ON THE RELEASE OF MINERAL NITROGEN IN FRESH TROPICAL SOILS. Agarwal, A. S.; Singh, B. R.; Kanehiro, Y. (Univ. of Hawaii, Honolulu). Indian J. Agr. Sci.; 42: No. 11, 1062-1064 (Nov 1972).

The immediate effect of $\gamma$ irradiation of samples of five soil types containing various combinations of clay, loam, and silt on the release of mineral nitrogen was studied following exposure to doses ranging from 0.1 to 3 Mrad. The greatest nitrate release was observed in the soil sample containing the highest amount of organic matter and the rate of nitrate release increased with dose. It is postulated that the release of nitrate from irradiated soil is related to effects of irradiation on soil bacteria and the release of bacterial enzymes to the soil. (CH)

**550** CHANGES IN MEAT AFTER TREATMENT WITH GAMMA RAYS. Changes in the Composition of the Free Amino Acids and the Soluble Proteins in Pork. Jordanov, I. (Veterinaren Inst. za Infektsiozni i Prazitni Bolesti, Sofia). Vet. Med. Nauki (Sofia); 9: No. 2, 43-51(1972). (In Bulgarian).

Changes were studied in the free amino acids and the soluble proteins in pork after treatment with $\gamma$ rays and during storage. Use was made of meat from the rump 2 to 3 days after slaughter and following packing in nylon bags and in kryovac envelopes under vacuum. Treatment was carried out by means of a γ device of a $^{60}$Co source at 11 to 15°C. The test samples were kept at 4 to 6°C and at room temperature. Results showed that no changes take place in the qualitative and quantitative composition of the free amino acids and the soluble proteins of pork after treatment at rates of up to 2.0 Mrad. At such rates, however, the mechanism of some tissue enzyme systems is probably adversely affected. This leads to certain quantitative changes in some free amino acids as well as to changes in the qualitative and quantitative composition of the soluble proteins. Packing in the presence or absence of oxygen has no effect on the changes observed in the free amino acids and in the soluble proteins. (auth)

**551** EFFECT OF GAMMA IRRADIATION ON POST-HARVEST PHYSIOLOGY OF FRUITS. Thomas, P.; Sreenivasan, A. (Bhabha Atomic Research Centre, Bombay). J. Sci. Ind. Res.; 29: No. 9, 414-423(Sep 1970).

A review of gamma irradiation effects on post-harvest physiology of fruits with special emphasis on bananas is reported. Various aspects of gamma-irradiation like effects on ripening of fruits, fruit respiration and ethylene production, texture of the fruits and vegetables, chemical constituents, etc., are discussed in detail. The sensitivity of the banana fruits to the ripening action of ethylene is found to decrease with gamma irradiation. Low-dose gamma irradiation indicates inhibitory effect on ripening process in bananas, which may prove to be beneficial for the fruit industry. It is also mentioned that judicious application of gamma rays can reduce the extent of ripening of fruits in transit and storage. Irradiation preservation of certain fresh fruits and vegetables is possible in countries where facilities and techniques for handling and storing such perishable commodities is limited. Technical problems involved in the use of ionizing radiations for extending the shelf-life of fruits by controlling ripening and senescence are reviewed. (INIS)

**552** STUDY OF IRRADIATED FROZEN EGGS DURING PROLONGED STORAGE. Popkov, V. N.; Yunin, A. N. Prikl. Biokhim. Mikrobiol.; 9: No. 1, 91-93(1973). (In Russian).

The effect of irradiation on whites of frozen eggs was studied immediately after exposure and during storage. The irradiation of frozen eggs with doses of 600 krad made it possible to store them at low temperatures (+2 to +4°C) for 180 days without changes in their organoleptic properties and nutrient value. (auth)

**553** STUDY OF THE FEASIBILITY OF RADIATION STERILIZATION OF PHARMACEUTICAL PREPARATIONS OF SOME ALKALOIDS AND SULFUR CONTAINING SUBSTANCES. Grachev, S. A.; Chakchir, B. A.; Ryabykh, L. D. (Inst. of Nuclear Physics, Leningrad). Khim.-Farm. Zh.; 7: No. 5, 47-50(May 1973). (In Russian).

The feasibility of radiation sterilization was studied on ephedrine hydrochloride, atropine sulfate, scopolamine hydrobromide, strychnine nitrate, morphine hydrochloride, codeine phosphate, proserine, cysteamine hydrochloride, and unithiol in form of injectable solutions and as powders. It was shown that the sterilizing dose of radioactivity results in a breakdown of the solutions as shown by changes in the pH, color, and loss of biological activity. Alkaloid powders exhibited no changes after radiation sterilization. Deaerated solutions were also stable to the radiation but such solutions could not be prepared easily under industrial conditions. Temperature had no effect on the stability of test samples except for very low temperatures. (JPRS)

**554** FURTHER EVIDENCE FOR A ROLE OF $H_2O_2$ IN RADIATION SENSITIZATION OF BACTERIAL SPORES. Cross, M.; Simic, M.; Powers, E. L. (Univ. of Texas, Austin). Int. J. Radiat. Biol.; 24: No. 2, 207-211(Aug 1973).

Formate, catalase (radical produced from formate), and $Co_2$ were used to prevent the accumulation of $H_2O_2$ through water radiolysis during anoxic x irradiation of bacterial spores in aqueous suspension. Survival curves for Bacillus megatherium over a range of 0 to 600 krads are presented for irradiations carried out in $5 \times 10^{-3}$M formate and 50 μg/ml catalase suspensions. Formate reduced the $N_2O$ sensitization to the unbuffered $N_2$ level. Similar results were obtained with catalase, but heat inactivation of the enzyme destroyed its ability, to reduce $N_2O$ sensitization. Carbon dioxide did not affect the sensitivity of the spores. It is pointed out that reaction of the OH radicals with $CO_2$ is very slow and no significant removal of ·OH took place under the experimental conditions used. It is argued that the results indicate a two-step mechanism for anoxic radiation sensitization, requiring the presence of the OH radical to complete some initial step, allowing $H_2O_2$ to complete the damaging sequence. (UK)

**555** EARLY INHIBITION OF CELLULAR DNA SYNTHESIS BY HIGH MULTIPLICITIES OF INFECTIOUS AND UV-INACTIVATED REOVIRUS. Shaw, J. E.; Cox, D. C. (Univ. of Oklahoma, Norman). J. Virol.; 12: No. 4, 704-710(Oct 1973).

Inhibition of cellular DNA synthesis began 6 to 8 h after reovirus infection at a multiplicity of infection of 10 PFU per cell. However, as the multiplicity of infection was increased to a maximum of $10^3$ PFU/cell, inhibition of DNA synthesis began earlier after infection (2 to 4 h postinfection), and the initial rate of inhibition increased. The enhanced inhibition of DNA replication at high virus multiplicities appeared to be selective since RNA synthesis was not detectably altered as late as 9 h postinfection and inhibition of protein synthesis did not begin until 7 to 9 h after infection. Early inhibition of DNA synthesis did not appear to be related to changes in thymidine pool characteristics, thymidine kinase activity, or detectable degradation of cellular DNA. Even though the particle-to-PFU ratio was increased by ultraviolet light inactivation of virus, the ability to induce early inhibition of DNA synthesis was not diminished. (auth)

**556** ULTRAVIOLET LAMP PASS-THROUGH CABINET FOR USE IN BOLL WEEVIL MASS-REARING FACILITY. Griffin, J. G.; Lindig, O. H. (Mississippi State Univ., State College). J. Econ. Entomol.; 66: No. 5, 1063-1066(15 Oct 1973).

A two-door ultraviolet (uv) or germicidal lamp pass-through cabinet and control system were developed for use in an Anthonomus grandis Boheman mass-rearing facility. The unit allows passage of materials between rooms, or between rooms and the outside, with better contamination control than is possible by using ordinary doorway passages. Tests showed that microbial organisms, which were suspended in air or spread in thin layers on filter paper, were destroyed when exposed to the radiation produced by the lamps in the unit. The control system was designed and installed so that only one door of the cabinet could be opened at one time. When either door was opened and then closed, both doors were locked and the uv lamps were activated and remained on for a preset length of time before either door could be opened. The uv lamps could not be operative when either door was open. Lamp fixtures were mounted in the cabinet so that any packages or containers placed in the cabinet were surrounded by germicidal lamp rays. (auth)

**557** CORRELATION OF RADIATION AND THERMAL EVENTS OF INACTIVATION IN BACILLUS MEGATERIUM SPORES. Richmond, R. C. Austin, TX; Univ. of Texas (1972). 187p. University Microfilms Order No. 73-18,487.

Thesis (Ph. D.).

B. megaterium spores mounted on cellulose filters were dried at less than $10^{-5}$ Torr, and then hydrated with water vapor to 22 Torr. They were then heated, or x-irradiated, or both, under half an atmosphere of nitrogen. Thermal inactivation of spores (112°C) in some instances was influenced by the rates of cooling following the heat treatment such that slow cooling was seen to increase survival, relative to fast cooling. The radiation sensitivity of these "slow cooled" and "fast cooled" spores was found to be different when slow cooling led to increased survival. Relative to unheated spores, fast cooled spores were slightly more sensitive to x-irradiation; slow cooled spores demonstrated a complex biphasic survival curve with low dose sensitive and high dose resistant responses. When slow cooling did not lead to an increased spore survival relative to fast cooling, the subsequent radiation response was identical for both kinds of cooled spores, this response being slightly more sensitive than unheated spores. That a history of slow cooling decreases the thermolability of spores suggests a functional renaturation of some spore component. That these slow cooled spores further demonstrate an altered, twofold radiation sensitivity suggests that the same spore component labile to heat is also sensitive to x-irradiation, and that renaturation of this sensitive component during the slow cooling process may lead to two conformational states, which are different from that originally found in the unheated spore. This possibility of conformational change in a spore component sensitive to both heat and radiation was further examined by testing for coincidental changes in heat and radiation sensitivity in spores first subjected to a range of salt and pH treatments, since both types of treatment are known to promote conformational changes in biopolymers. The fact that sensitive spores in these cases were generated by the distilled water soaking after the salt exposure, but not the salt stress per se, suggests that spore permeability may be altered to allow an increased degree of hydration, or the outward mobilization of the spore ionic load during the hypotonic rinse in some manner disrupts an ionic balance required to maintain a particular conformational state of a heat and radiation sensitive component. Although no increased sensitivity to either heat or x-irradiation in spores hydrated through the vapor phase was observed, the x-ray sensitivity of anoxically prepared spores in suspension was increased at a $2 \times 10^{-3}$ M silver(I) concentration to the level seen in oxygen. These results suggest that silver(I) acts to increase radiation damage via water radiolysis. The silver(I) compartment of sensitization was largely removed by t-butanol, suggesting the mode of silver(I) sensitization operates through the hydroxyl radical. (Diss. Abstr.)

**558** REPAIR OF X-RAY INDUCED DAMAGE IN MICROCOCCUS RADIODURANS AND A SENSITIVE MUTANT. Bonura, T. Buffalo; State Univ. of New York (1973). 144p. University Microfilms Order No. 73-19,175.

Thesis (Ph. D.).

The parameters of x-ray-induced DNA degradation, DNA synthesis delay, and strand break rejoining were studied and compared in two strains of Micrococcus radiodurans, a wild-type resistant strain and a sensitive mutant, UV17. The $D_37$ and $D_q$ of the wild-type cell is greater than the mutant and the slope of the mutant curve is 4.6 times as steep as the wild-type curve. The DNA synthesis delay is approximately 3 times as long as in wild-type cells over a limited useful range of doses. The rate of DNA breakdown is approximately the same in both strains, the extent of breakdown and the time for completion of DNA degradation being 3 times greater in the mutant. In both strains, the initial rate of breakdown is independent of dose in TGY growth medium. Post-irradiation incubation in phosphate buffer inhibits DNA degradation to a much greater extent in wild-type cells than in UV17. In addition UV17 shows a dose dependence of the rate of breakdown under these conditions. The time at which DNA breakdown ends and exponential synthesis begins coincide in both strains. The rapid component of the strand break rejoining system is markedly reduced in UV17, however, strand breaks produced during irradiation at 4°C in buffer may be restituted slightly more efficiently in UV17 than in wild-type cells. Wild-type cells can restitute a portion (70 to 80%) of the breaks remaining after irradiation by incubation in phosphate buffer for 90 minutes whereas UV17 cannot. Both cells appear able to restitute a fixed number of strand breaks when incubated under growth conditions. The nuclease and DNA polymerase activities of both strains were studied in vitro. The in vivo and in vitro observations are correlated and a molecular mechanism for the increased sensitivity of UV17 is discussed as well as a mechanism for the replication of DNA utilizing an interrupted template such as may be the case with wild-type cells. (Diss. Abstr.).

**559** EFFECT OF GAMMA RADIATION ON PROTEIN NITROGEN OF THE ALGA DUNALIELLA BIOCULATA. Saraiva, M. C.; Roussel, J. (Institut Oceanographique, Paris). Bot. Mar.; 15: No. 4, 215-217(1972). (In French).

The evolution of the protein nitrogen in Dunaliella bioculata after $\gamma$ irradiation was followed as a function of the radiation dose received, as a function of the time elapsed after irradiation, and as a function of the increase of the volume of the cells irradiated. The results showed that the quantity of protein nitrogen per cell increases as a function of the irradiation dose received. This evolution is not immediately detectable. The quantity of protein nitrogen per cell does not evolve obviously with time after irradiation with the exception of strong doses for which the evolution is a function of the dose received. The mean quantity of protein nitrogen is correlated positively with the mean cellular volume. (JSR)

**560** RADIATION AND NONRADIATION-INDUCED DEGRADATION OF T4 DNA DURING INFECTION OF ESCHERICHIA COLI AT LOW MULTIPLICITIES OF INFECTION. Marsden, H. S. University Park, PA; Pennsylvania State Univ. (1973). 105p. University Microfilms Order No. 73-24,021.

Thesis (Ph. D.).

During the infection of Escherichia coli by T4 at low multiplicities of infection a fraction of the genome is degraded. This thesis shows that there are two components to this degradation: one is radiation-induced and the other is non-radiation-induced. Evidence is presented which shows that the radiation-induced degradation is initiated at ionizing radiation lesions in the DNA. The degradation is mediated by the recBC nuclease and subsequently by some other unknown nuclease(s). The experiments indicate that there is a cellular, inducible inhibitor of the recBC nuclease. The recA gene product is probably required for its induction. The exr locus may code for the inhibitor or regulate the expression of the inhibitor. The radiation-induced degradation products from both cellular and T4 phage DNA are the same. They are primarily thymine and a phosphorylated derivative in about the ratio 4 to 1. Thymidine is absent. The non-radiation-induced component usually amounts to $1\frac{1}{2}$% to 2% of the phage genome but sometimes goes as high as $3\frac{1}{2}$%. The similarity between the amount of degradation and the extent of terminal redundancy (1% to 3%) was intriguing because of the possible functional relationship between the degradation observed and the degradation of the terminally redundant region which must be a prerequisite to possible circularization of the phage genome. However, by using T4 mutants with different amounts of terminal redundancy it was shown that the extent of non-radiation-induced degradation was independent of the extent of terminal redundancy. (Diss Abstr. Int., B)

**561** DEVELOPMENT OF ULTRAVIOLET RESISTANCE IN SPORULATING BACILLUS CEREUS T. Germaine, G. R.; Coggiola, E.; Murrell, W. G. (Commonwealth Scientific and Industrial Research Organization, North Ryde, Australia). J. Bacteriol.; 116: No. 2, 823-831(Nov 1973).

Ultraviolet (uv) resistance patterns of sporulating Bacillus cereus were determined. Six different categories of uv resistance were discernible as the organism progressed from exponential growth to the free, mature spore. Light microscope observations allowed the assignment of certain sporulation stages to specific uv resistance categories. Marked changes in uv resistance were associated with stages III, mid-IV, and post-IV of sporulation. Dipicolinic acid was shown to sensitize forespores to uv radiation. Mechanisms invoked to explain the different uv categories are discussed. (auth)

**562** SUPPRESSION OF LEX MUTATIONS AFFECTING DEOXYRIBONUCLEIC ACID REPAIR IN ESCHERICHIA COLI K-12 BY CLOSELY LINKED THERMOSENSITIVE MUTATIONS. Mount, D. W.; Walker, A. C.; Kosel, C. (Univ. of Arizona, Tucson). J. Bacteriol.; 116: No. 2, 950-964(Nov 1973).

A major class of ultraviolet (uv)-resistant derivatives of $lex^-$ strains of Escherichia coli K-12 grows normally at 30°C but at 42.5°C fails to produce colonies on complete or minimal agar. At 42.5°C these thermosensitive strains form filaments without septa, due to an apparent defect in cell division. Deoxyribonucleic acid degradation in uv-irradiated cultures of the thermosensitive strains is slow, in contrast to the rapid degradation in uv-irradiated cultures of the parental $lex^-$ strains. The thermosensitive mutations (tsl) are tightly linked (less than 0.04 min on the E. coli K-12 linkage map) to the site of the lex mutation in the parental strain and could lie within the same gene. The $tsl^+/tsl^-$ heterozygotes grow at 42.5°C and are uv resistant when grown at 30 or 42.5°C. The tsl mutations are, therefore, recessive in contrast to lex mutations, which are dominant. It appears likely that the tsl mutations alter the diffusible product that gives rise to the $Lex^-$ mutant phenotype. This product appears to be necessary for deoxyribonucleic acid repair and cell division. (auth)

**563** DNA DEGRADATION AFTER UV IRRADIATION IN RELATION TO SURVIVAL RATE AND DIMER EXCISION IN ESCHERICHIA COLI CELLS. Stefunkova, E.; Maskova, L.; Sedliakova, M. (Cancer Research Inst., Bratislava). Stud. Biophys.; 36-37: 105-112(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Preirradiation starvation for essential amino acids will diminish postirradiation DNA degradation if DNA synthesis takes place during starvation. Simultaneous inhibition of DNA and proteosyntheses applied prior to irradiation will protect cells against degradation to a smaller degree than aminoacid starvation alone. Postirradiation DNA degradation as well as survival of cells appear to be capable of being positively influenced by completion of replication cycles. (auth)

**564** UV-INDUCED MUTATIONS AND REPAIR IN THE PHAGE LAMBDA SYSTEM OF E. COLI. Polukhina, G. N.; Ravin, V. K. (Inst. for Genetics, Moscow). Stud. Biophys.; 36-37: 97-104(1973). (In Russian).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

UV induced mutations and repair in the phage lambda system of E. coli. The role of repair systems and of recombination in the induction of mutations in phage lambda was analyzed in both uv-irradiated extracellular phage and the uv-irradiated host strain. The frequency of induction of C mutants in irradiated suspensions of phage lambda after plating on $rec^+$ $UVR^+$ strain was not raised as compared with that observed after plating on a $UVR^-$ strain at the identical doses of radiation. The frequency of induction of mutations per 1 lethal hit was higher for the strain $UVR^-$ than for the $UVR^+$. The frequency of induction of C mutants of phage lambda $i^{434}$ was increased after the simultaneous infection of the cell with both phage lambda and phage lambda $i^{434}$. (auth)

**565** INFLUENCE OF HOST CELL REPAIR GENES ON THE SURVIVAL OF PHAGES $T_3$, $T_7$, AND $T_5$ B AFTER TREATMENT WITH 8 METHOXYPSORALEN PLUS LONG WAVELENGTH UV LIGHT. Godsell, A.; Collis, T.; Clarke, C. (Univ. of East Anglia, Norwich, Eng.). Stud. Biophys.; 36-37: 81-96(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Following irradiation of phages $T_3$, $T_7$, and the HCR- suspectable type of $T_5$ ($T_5$ B) with long wavelength uv light, in the presence of

8- methoxypsoralen, survival was assayed on a variety of E. coli host strains differing in known dark-repair functions. In some experiments survival was assayed in the presence or absence of caffeine, at a concentration of 500 μg/ml, to effect phenotypic blockage of the HCR, excision repair, system. Results show that in the case of phages $T_3$ and $T_7$ the photosensitized damage is repaired by excision repair, and to a lesser extent by the host cell rec gene system. No influence of exr or pol A gene functions on phage survival was found. In the case of phage $T_5$ B damage by long wavelength UV + 8-methoxysoralen is repaired by the HCR (excision repair) and pol A systems, but no effect of exr or rec host genes on phage survival was found. (auth)

**566** EFFECT OF LOW DOSES OF ULTRAVIOLET RADIATION ON BACTERIOPHAGES. Hradecna, Z.; Toufarova, D.; Korcakova, I. (Inst. of Biophysics, Brno). Stud. Biophys.; 36-37: 75-80(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Low doses of uv radiation can increase the resistance of the phage to x rays. When phage is irradiated with x rays and pretreated with UV an increase in resistance to x rays can be observed. This effect was observed in phages lambda,$T_3$, and $T_7$ but not in phages $T_2$ and $T_4$. (auth)

**567** GENETIC PROPERTIES OF THE UV-IRRADIATED DNA OF PHAGE T4B. Vinetski, Yu. P.; Aleksandrova, N. M. (Inst. for Genetics, Moscow). Stud. Biophys.; 36-37: 67-73 (1973). (In Russian).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

The inactivation curves of $rII^+$ markers of uv irradiated phage T4B transforming DNA have 2 components. First, rapid inactivation of $rII^+$ markers is observed, but the basic component has an exponential form. A comparison of the slopes of inactivation curves with the length of rII deletion markers shows that these are not proportional. This is apparently related to the damage of the neighbouring regions of DNA with the markers important for the recombination of the donor and recipient DNA. The genetic analysis of the progeny of transformation showed that unselected rII (am) markers of irradiated DNA localized in the regions of recombination are excluded. Additivity of uv and DNase action on DNA was observed. On the basis of the experiments on the simultaneous action of uv and DNase the size of the minimum regions in the donor DNA necessary for effective recombination were estimated (120 to 450 nucleotides per DNA strand). (auth)

**568** INFLUENCE OF PHYSIOLOGICAL FACTORS ON THE RESISTANCE TO ULTRAVIOLET RADIATION IN BACTERIA. Sedliakova, M. (Cancer Research Inst., Bratislava). Stud. Biophys.; 36-37: 59-66(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Intracellular changes induced by various modes of interference were studied and possible interrelations between such changes and enhanced resistance were investigated. Experiments were conducted on the effects of amino acid prestarvation on the restoration steps after uv doses dimerizing about 0.15% of thymine in Escherichia coli. The starvation of cells for amino acids markedly enhanced the fractions of survivors in the excision proficient strains. Sedimentation profiles of DNA synthesized after uv irradiation were investigated by centrifugation in alkaline sucrose gradients in order to gain more information about the nature of the mechanism enabling cells to tolerate unexcised dimers. (HLW)

**569** ULTRAVIOLET MUTAGENESIS AS STUDIED USING THE SINGLE STRANDED-DNA PHAGE OX-174. Zavil'gel'skii, G. B. (Inst. of Molecular Biology, Moscow). Stud. Biophys.; 36-37: 301-310(1973). (In Russian).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Using the mutant am 3oX-174 phage containing single-stranded DNA as a model the reversion to the wild type induced by the action of uv light on the phage and the host bacterium was studied. The reversion frequency under the action of uv light on the phage or the bacterium separately was shown to increase by 1.3 to 2 times only. The uv action on both the bacterium E. coli C ($hcr^+$) or E. coli $C_{syn}$ -($hcr^-$) and the phage caused the increase in the reversion frequency by 20 to 70 times as compared with the natural background (uv mutagenesis). The uv mutagenesis degree was strongly dependent on the uv dose on bacterium and had a maximum value at 200 to 300 erg/mm$^2$ for E. coli C and 20–30 erg/mm$^2$ for E. coli $C_{syn}$-. Decrease in the concentration of pyrimidine dimers in the host DNA in the process of the photoreactivation caused a shift of the optimum of uv dose for phage reversion: at irradiation of the bacteria E. coli C–from 200 to 800 erg/mm$^2$, at irradiation of the bacteria E. coli $C_{syn}$- from 20 to 70 erg/mm$^2$. The results show that genes controlling excision repair in bacteria (uvr or hcr) do not seem to be required for the phenomena of uv reactivation and uv mutagenesis in bacteriophage with single-stranded DNA. (auth)

**570** MUTATION FREQUENCY DECLINE AND ITS RELATIONSHIP TO EXCISION REPAIR. Clarke, C. H. (Univ. of East Anglia, Norwich, Eng.). Stud. Biophys.; 36-37: 277-300 (1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

A review is presented of studies on mutation frequency decline in uv-irradiated bacteria and its relationship to excision repair. Topics discussed are: localized and generalized excision repair as explanations for mutation frequency decline; the specificities of mutation frequency decline and the broth effect; repair of lethal damage during mutation frequency decline; thymine dimer excision rates and their relationship to mutation frequency decline; relation of mutation frequency decline-susceptible lesions to non-dimer damage; $MFD^-$ mutants and their properties; and mutation frequency decline for non-uv damage. (HLW)

**571** INTERACTION OF MANGANOUS IONS WITH DNA REPAIR AFTER UV IRRADIATION IN PROTEUS MIRABILIS. Hofemeister, J. (Zentralinstitut fuer Genetik und Kulturpflanzenforschung, Berlin). Stud. Biophys.; 36-37: 263-269(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Following uv irradiation cells were incubated in a Tris-HCl buffer supplemented with glucose, $MnCl_2$, or $MgCl_2$. Following incubation in LHR buffer, cells were plated on a medium containing caffeine; there was a low sensitivity of the unirradiated wild-type cells under these conditions. However, after uv irradiation a nearly complete inhibition of recovery was observed. The known inhibitory action of caffeine and 2,4-dinitrophenol was compared with that of Mn ions on liquid-holding recovery, dimer excision, and breakdown of DNA after uv irradiation. Liquid-holding recovery was inhibited by caffeine and Mn ions, whereas 2,4-dinitrophenol had a relatively weak influence on liquid-holding recovery. Mn ions and 2,4-dinitrophenol lowered the dimer excision rate to about 70% of the $MgCl_2$-containing control. Caffeine inhibited the breakdown of DNA after uv irradiation while Mn ions stimulated DNA breakdown. (HLW)

**572** INFLUENCE OF CAFFEINE ON REPAIR PROCESSES AFTER UV IRRADIATION. Soska, J.; Necasova, J. (Inst. of Biophysics, Brno). Stud. Biophys.; 36-37: 259-262(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Glucose starvation prior to uv irradiation of lactobacillus acidophilus results in a shoulder on the dose-survival curve, but, in contrast to amino acid prestarvation, this shoulder is not prevented by simultaneous thymidine starvation. Caffeine treatment after uv irradiation also causes a shoulder and increases survival. The hypothesis is put forward that the excision system of lactobacillus contributes to the cell death after irradiation and that the inhibition of excision by caffeine allows other repair systems to operate. The shoulder is then the result of a nonexcision repair system. (auth)

**573** COMPARISON OF REPAIR PROCESSES AFTER UV- AND PHOTODYNAMIC ACTION IN PROTEUS MIRABILIS. Jacob, H. E. (Zentralinstitut fuer Mikrobiologie und Experimentelle Therapie, Jena, Ger.). Stud. Biophys.; 36-37: 253-257 (1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Differences between repair processes were stated by means of repair-inhibitors. Caffeine inhibits only the repair of DNA after uv-inactivation. After photodynamic action, quinacrine has the same effects as described for repair of x-ray damage. These results are in good agreement with the phenotypic characterization of the bacterial strains examined. (auth)

**574** INHIBITION OF THYMINE-DIMER EXCISION AFTER PREIRRADIATION INHIBITION OF DNA SYNTHESIS BY CYTIDINE. Brozmanova, J.; Maskova, L.; Sedliakova, M. (Cancer

Research Inst., Bratislava). Stud. Biophys.; 36-37: 245-252 (1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

The effect of preirradiation inhibition of DNA synthesis by cytidine on ultraviolet resistance and thymine-dimer excision was investigated. Pretreatment with cytidine was found to inhibit thymine-dimer excision in the cells of Escherichia coli B/r Hcr$^+$. When this effect was combined with a simultaneous effect of amino acid prestarvation, the number of surviving cells after uv irradiation was slightly higher than in the logarithmically growing culture. However, in the former, excision was reduced to about 50%. This indicates that the cells having any excision capacity do not necessarily need to cope with dimers by excision. (auth)

**575** ETHIDIUM BROMIDE INHIBITION OF DARK REPAIR PROCESSES IN ULTRAVIOLET-IRRADIATED $T_1$ BACTERIOPHAGE AND BACTERIA. Shankel, D. M.; Molholt, B. (Univ. of Kansas, Lawrence). Stud. Biophys.; 36-37: 235-244(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Ethidium bromide (EB), an intercalating dye, was shown to be a potent inhibitor of the host cell reactivation of ultraviolet (uv)-treated bacteriophage $T_1$, and of the dark repair of premutational damage produced by low dosages of uv-administered to Escherichia coli. Incorporation of 5 μg/ml EB in the plating medium completely inhibits the host cell reactivation of the phage $T_1$, in E. coli B, but shows no effect in E. coli $B_{S-1}$. At lower concentrations the degree of host cell reactivation is proportional to the concentration of the dye. For studies on inhibition of dark repair of premutational damage two mutations were employed, the forward mutation to high level streptomycin resistance and the reverse mutation from tryptophane requiring (try$^-$) to tryptophane independence (try$^+$). For both types of mutations a strong mutation enhancement effect was observed in E. coli strains possessing the host cell reactivation system (hcr$^+$) when EB was included in the post-irradiation expression medium in concentrations of 1-5 μg/ml. Conversely, in cells lacking the system (hcr$^-$) an antimutagenic effect results from the presence of the dye. The presence of low concentrations of the dye also influences post-UV survival in the hcr$^+$ strain, but not in the hcr$^-$ strain. Pretreatment of the cells with EB does not affect the survival of either strain. EB in concentrations above 5-10 μg/ml is normally lethal for these strains of E. coli. A mutant strain resistant to high levels (500 μg/ml) of the dye has been developed. Survival curves show that the mutant has the same uv resistance as the parent. Greatly increased concentrations of the dye are required to inhibit dark repair in the mutant. (auth)

**576** EXCISION OF PYRIMIDINE DIMERS FROM THE DNA OF UV-IRRADIATED PROTEUS MIRABILIS WILDTYPE AND UV-SENSITIVE MUTANTS. Stoerl, K.; Mund, C. (Zentralinstitut fuer Mikrobiologie und Experimentelle Therapie, Jena, Ger.). Stud. Biophys.; 36-37: 229-233(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Two photoproducts, thymine-thymine and cytosine-thymine dimers were identified after uv-irradiation of Proteus mirabilis. It was found that 1 erg/mm$^2$ at 253 nm produced about 8 dimers per $10^7$ nucleotides. Both photoproducts were excised at the same rate from the DNA of ultraviolet-resistant wildtype-cells, but remained in the DNA in the ultraviolet-sensitive HCR-mutants. EXR-mutants also revealed an ability to excision. The excision of the REC-mutant could not be specified, because of high DNA-degradation. In comparison with the wildtype mutants exhibit a very reduced ability to excise pyrimidine dimers. (auth)

**577** PHOTOREACTIVATION OF ULTRAVIOLET SINGLE-STRANDED PHAGE DNA AS OBSERVED IN EXPERIMENTS IN VIVO AND IN VITRO. Zavil'gel'skii, G. B.; Zavil'geel'skaya (Inst. of Molecular Biology, Moscow). Stud. Biophys.; 36-37: 221-227(1973). (In Russian).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Using the phage l $\varphi-7$ and its infectious single-stranded DNA as a model of the photoreactivation (PHR) in vivo (in bacterium or spheroplasts Escherichia coli C (uvr$^+$) and E. coli $C_{syn}$-(uvr$^-$)) and in vitro, with yeast PHR-enzyme was studied. The PHR-sector for the DNA l $\varphi-7$ in vitro is 52%, or 0.52. This is an indication that in the single-stranded DNA l $\varphi-7$ = 50% of the uv-inactivation may be ascribed to the formation of pyrimidine dimers (the PHR-sector for the double-stranded DNA is 0.9). The PHR-sector for the phage l $\varphi-7$ and its infectious DNA in vivo at assays performed using E. coli C is 0.10–0.15, and using E. coli $C_{syn}$- is 0.3 or 30%. It is believed that the small PHR-effect for the phages with single-stranded DNA in E. coli C (uvr$^+$) may be the result of competition of the uv-endonucleases and PHR-enzyme at the uv-lesions in the phage DNA. (auth)

**578** EXCISION AND RECOMBINATION IN THE REPAIR OF DNA IN BACTERIA TREATED WITH ULTRAVIOLET LIGHT OR CROSS LINKING AGENTS. Howard-Flanders, P.; Cole, R. S.; Ma, P. F. (Yale Univ., New Haven). Stud. Biophys.; 36-37: 211-220(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Several mechanisms for the enzymatic repair of cellular DNA containing structural damage of various kinds are discussed. Pyrimidine dimers formed by ultraviolet irradiation may be monomerized in position by photoreactivation enzyme, or excised from the DNA following the action of an endonuclease specific for certain kinds of damage in the DNA. After excising the pyrimidine dimer the gap so formed is filled in with nucleotides complementary to the opposing strand, which serves as template. Dimers not excised in advance of replication may pass through the growth fork, leaving postreplication gaps opposite each dimer. Genetic exchanges between the sister duplexes lead to the insertion of the correct bases into the postreplication gaps, and to the reconstruction of the correct base sequence in the daughter strands. Genetic exchanges are caused by the dimers and postreplication gaps with high efficiency. Both excision repair and recombinational repair are needed for the full ultraviolet resistance of normal wild type cells. Interstrand cross links can be produced in the DNA of cells by treatment with certain drugs, such as bifunctional alkylating agents, mitomycin C, or by treatment with the photosensitizing agent, psoralen, in combination with 360 nm wavelength light. The properties of the psoralen crosslinks are especially favorable for experiments on the mechanisms of DNA repair. The production of crosslinks by all these agents is accompanied by the formation of a much larger number of adducts affecting one strand only. Bacteria and animal cells generally survive the formation of many tens or hundreds of crosslinks in their DNA while retaining the capacity for cell proliferation. DNA containing crosslinks cannot be repaired by excision alone. If one arm of a crosslink is excised from the first strand, the second arm remains attached to the other strand in a position where it will block repair of the first strand by DNA polymerase. However, DNA containing crosslinks excised from one strand can initiate genetic exchanges with homologous molecules, enabling the gaps opposite the excised crosslinks to be filled in with the correct base sequences from the homologue. Excision must occur before exchanges can take place as none occur in excision-defective mutants carrying uvrA$^-$. After the gap left by excision in the first strand has been filled in, the second arm of the crosslink can be excised and the repair of both strands thus completed. (auth)

**579** RELATIONSHIP OF POSTIRRADIATION REPAIR PROCESSES TO THE PROTEIN SYNTHESIS AND SYNTHESIS OF DNA. Necasova, J.; Soska, J. (Inst. of Biophysics, Brno). Stud. Biophys.; 36-37: 121-126(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Amino acid starvation or other inhibitions of protein synthesis prior to uv-irradiation of Lactobacillus acidophilus resulted in a shoulder on the dose-effect curve. The appearance of this shoulder was prevented, if together with the inhibition of protein synthesis DNA synthesis was also inhibited. On the contrary, amino acid starvation post irradiation resulted in no shoulder, but the shoulder resulted, if both protein synthesis and DNA synthesis were inhibited after irradiation. On the basis of these results, a temporary lag of DNA after uv irradiation is considered to be an important condition allowing the repair to take place. (auth)

**580** EFFECT OF UV LIGHT ON THE BASIDIOMYCETE OUDEMANSIELLA MUCIDA. Semerdzieva, M.; Blumauerova, M. (Inst. of Microbiology, Prague). Stud. Biophys.; 36-37: 183-189(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Spores of Oudemansiella mucida were exposed to ultraviolet radiation and N-methyl-N$^1$-nitro-N-nitrosoguanidine for studies on mutagenesis. The basidiospores were more resistant to ultraviolet radiation than spores of ascomycetes. Small doses of radiation did not inhibit the germination of basidiospores. Spores that had germinated for 24 hrs were eight times more sensitive to ultraviolet than nongerminated spores. The germinated spores were also more sensitive to MNG. Mutations were observed in morphology of fruiting bodies, antibiotic production, and nutritional properties. (HLW)

**581** SURVIVAL, DNA SYNTHESIS, AND THYMINE DIMER EXCISION AFTER ULTRAVIOLET IRRADIATION IN A THERMOSENSITIVE STRAIN OF ESCHERICHIA COLI. Masek, F.; Cesko, M.; Sedliakova, M. (Cancer Research Inst., Bratislava). Stud. Biophys.; 36-37: 399-406(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Survival of cells, DNA synthesis, and excision of thymine dimers after ultraviolet irradiation in the thermosensitive mutant of Escherichia coli were followed. When restrictive temperature was applied after irradiation, the enhancement of cell survival and DNA synthesis was not accompanied by increased excision of thymine dimers. When restrictive temperature was applied before irradiation, survival of cells and DNA synthesis did not become enhanced, but there was enhanced kinetics of dimer excision. (auth)

**582** MULTIPLICITY REACTIVATION OF HERPES SIMPLEX VIRUS INACTIVATED BY ULTRAVIOLET LIGHT. Roubal, J.; Vonka, V. (Inst. of Sera and Vaccines, Prague). Stud. Biophys.; 36-37: 371-373(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

A three-component survival curve of uv-irradiated herpes simplex virus was observed; the second component appeared to be the result of host cell repair, while the third component was due to multiplicity reactivation. Plaque count of non-irradiated virus did not increase after the fourth day after infection, while in cultures inoculated with heavily irradiated virus new plaques appeared until the seventh day. The plaque size decreased with increasing uv doses. (HLW)

**583** TEMPERATURE-SENSITIVE MUTANT OF E. COLI WITH DEFECTIVE REPAIR CAPACITY. Morfiadakis, I.; Geissler, E.; Theile, M. (Univ., Rostock, Ger.). Stud. Biophys.; 36-37: 361-369(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

A mutant of Escherichia coli that shows a striking decrease in repair capacity at elevated temperatures is described. Differences in repair from lesions caused by uv irradiation, mitomycin C, and photodynamic action are discussed. Figures are presented to show survival curves following irradiation at different temperatures and after treatment with mitomycin C. (HLW)

**584** CHANGES IN THE FREQUENCY AND SPECTRA OF AUXOTROPHIC MUTATIONS IN E. COLI UNDER THE COMBINED ACTION OF CHEMICAL MUTAGENS AND UV LIGHT. Panfilova, Z. I. (Inst. of Cytology and Genetics, Novosibirsk, USSR). Stud. Biophys.; 36-37: 355-360(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

A number of chemical mutagens (hydrohylamine, formaldehyde, and others) being combined with low mutagenic doses of uv rays result in increasing and widening of the spectrum of auxotrophic mutations in E. coli as compared with the effects of each of the above mentioned compounds used alone. The higher the dose of uv-rays, the more effective were these chemical mutagens and the wider was the variety of mutations observed. It is suggested that uv rays denature definite DNA regions making them more sensitive to the action of a number of chemical mutagens. (auth)

**585** EFFECT OF ACRIDINE ORANGE PRETREATMENT OF PHAGE $s_d$ ON THE MUTAGENIC AND LETHAL ACTION OF UV IRRADIATION. Kriviskii, A. S.; Esipova, V. V.; Koudelka, J. (Inst. of Genetics and Selection of Industrial Microorganismen, Moscow). Stud. Biophys.; 36-37: 343-354(1973). (In Russian).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

The binding of acridine orange (AO) to phage $s_d$ E. coli SK at final concentration $2 \times 10^{-5}$M is accompanied by rapid decrease of phage survival by ≈5 orders of magnitude. Simultaneously DNA is released into solution as shown by increase of viscosity, by appearance of disrupted phages and by changes in AO binding detected in absorption spectra. Comparable inactivating effect was observed with methylene blue but not with proflavine and 5-aminoacridine. Bacteriophages that survived the AO-treatment are resistant to the second treatment of dye, but the progeny of these phages are AO-sensitive. The dark treatment with AO leads to a substantial increase of the proportion of phage plaque-mutants. These mutants are AO-resistant and their accumulation is shown to be a result of AO-selection but not AO-induction. AO-pretreatment at $2 - 5 \cdot 10^{-5}$M protects the bacteriophage from the lethal effect of uv irradiation ($\lambda = 254$ nm). AO-protection is not due to the absorption of the uv quanta by AO. AO-pretreatment leads to a great enhancement of the mutagenic effect of uv irradiation on the surviving after AO-treatment phage $s_d$; for example, at 300 erg/mm$^2$ the amount of mutants among surviving phages is as high as 15 - 20% (after subtraction of the blank value caused by dark effect of AO), while only 2.4% of the mutants was observed after uv irradiation of the untreated phage. 5-fold dilution of the phage pretreated with $5 \times 10^{-5}$M AO prevents all the effects of AO on the action of uv. Hence the changed response of pretreated bacteriophage to uv-irradiation is due to the presence of AO in the DNA, not to an irreversible impairment of phage DNA. In contrast to what was observed with uv, AO at $2 \cdot 10^{-5}$M protects the bacteriophage $s_d$ from both lethal and mutagenic effects of ionizing irradiation. The possible mechanisms of the bacteriophage protection from uv and x-ray inactivation and x-ray mutagenesis as well as AO-stimulation of uv mutagenesis are discussed. (auth)

**586** ISOLATION AND CHARACTERIZATION OF E. COLI B/R MUTANT HAVING A HYPER-HCR PHENOTYPE. Collis, T.; Clarke, C. (Univ. of East Anglia, Norwich, Eng.). Stud. Biophys.; 36-37: 325-342(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Following nitrosoguanidine mutagenesis approximately 2000 colonies of Escherichia coli B/r were screened by a spot-testing technique for ability to reactivate uv-irradiated phage $T_3$ to an enhanced extent. One such hyper-reactivating (HRH) mutant was isolated. This isolate has the same growth rate and uv-sensitivity as the parental E. coli B/r strain. However, it shows a greatly enhanced ability to repair uv-irradiated phages $T_1$, $T_3$, and $T_7$. There is a very small enhancement of $T_4$ survival, but no measurable increase in the survivals of uv-irradiated phage $T_6$ or the HCR-susceptible type of phage $T_5$. The HRH property applies also to $T_3$ or $T_7$ phage inactivated by 8-methoxypsoralen plus long wavelength uv, methyl methanesulfonate, and ethyl methanesulfonate, but not, to any marked extent, to inactivating damage to these phages caused by nitrous acid on di-epoxybutane. The HRH mutant shows enhanced uv-reactivation ability compared with its B/r parent, but MMS-treated phage $T_3$ survives the secondary effects of methylation, possibly depurination, less well on the HRH than on the B/r host. A speculative hypothesis to explain these findings is that the HRH mutant lacks an exonuclease which normally limits the efficiency of the excision repair of phage, but not bacterial, DNA. (auth)

**587** INDUCTION OF ROUGH COLONY MUTANTS IN SACCHAROMYCES CEREVISIAE BY HIGH DOSES OF UV LIGHT. Silhankova, L. (Inst. of Chemical Tech., Prague). Stud. Biophys.; 36-37: 323-324(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Ultraviolet radiation induced rough mutants in some strains of Saccharomyces cerevisiae. Test crosses of smooth cells isolated from the rough mutants were suppressed rough mutants. Four isolated suppressed roughs were unstable and formed rough colonies in frequencies of 1 to 5% during vegetative growth. About 30% of suppressed roughs recovered rough phenotypes in a medium containing lactate instead of sugar. (HLW)

**588** MUTAGENESIS IN PHAGE VIr OF PROTEUS MIRABILIS. Witte, W. (Martin-Luther-Univ., Halle, Ger.). Stud. Biophys.; 36-37: 319-321(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

The frequencies of uv-radioinduced mutations from tryptophan-dependence to tryptophan-independence of adsorption and from temperature-sensitivity to wild type behavior were measured. Ultraviolet-induced mutagenesis was decreased by defective host-cell-reactivation and by a gene defect of the phage. Photoreactivation reduced the uv-induced mutagenesis to the same extent as survival was enhanced. Following x-irradiation, survival of the mutant VIr was lower than that of the wild type. X-ray induced mutagenesis was also decreased. The results showed that uv-induced mutagenesis in phage VIr was independent of general recombination. (HLW)

**589** INFLUENCE OF ENERGY METABOLISM ON THE REPAIR OF X-RAY DAMAGE IN LIVING CELLS. III. Effect of 2-Deoxy-D-Glucose on the Liquid-Holding Reactivation in Yeast. Jain, V. K.; Pohlit, W.; Purohit, S. C. (Gesellschaft fuer Strahlen- und Umweltforschung, Munich). Biophysik; 10: No. 2, 137-142(1973).

Effects of the glucose antimetabolite, 2-deoxy-D-glucose (2DG), on liquid-holding reactivation (LHR) in x-irradiated yeast cells were studied. LHR in respiratory-deficient mutants is completely inhibited at a molar concentration ratio 2DG/glucose equal to 1, whereas for the wild-type this ratio is 10. Significance of these results for a radiochemotherapy of tumors is discussed. (auth)

**590** EFFECT OF RADIATION SENSITIVITY AND CELL STAGE ON LIQUID HOLDING RESPONSE IN SCHIZOSACCHAROMYCES POMBE. Shahin, M. M.; Nasim, A. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Mol. Gen. Genet.; 122: No. 4, 331-338(1973).

The response of the wild-type strain and 20 different radiation-sensitive mutants of S. pombe to liquid holding after uv irradiation was investigated. Three of the sensitive mutants tested showed appreciable liquid-holding recovery, as opposed to the negative liquid-holding effect observed in the wild-type cells. One of these mutants is reported to recombination-deficient while the other two have a normal recombination capability. Further experiments were carried out by using $G_1$ cells and ascospores to test the possible role of a recombinational type of repair pathway in the failure of wild-type S. pombe to slow liquid-holding recovery. Data from such studies indicated that the negative liquid-holding effect observed in the wild type cannot be ascribed to this particular pathway. This conclusion is further supported by the observation that caffeine, which is believed to inhibit mainly the recombinational repair in this yeast, did not alter the negative liquid-holding effect in the wild type. This observation implies that the caffeine-sensitive repair process occurs only in a rich medium and not in the nonnutrient solution. Data are discussed as these relate to possible cause(s) of negative liquid-holding effect in this organism. (GE)

**591** NUCLEAR AND EXTRANUCLEAR MUTATIONS IN YEAST INDUCED BY ETHYL METHANESULFONATE. Nesvera, J. (Charles Univ., Prague). Folia Microbiol. (Prague); 18: No. 5, 353-360(1973).

When zero-point mutations were induced in the yeast Saccharomyces cerevisiae using ethyl methanesulfonate (EMS) no differences were found in the frequency of auxotrophic mutants formed by a short and a prolonged treatment of the agent at equal survival level. The expression of a part of the mutations induced by a prolonged EMS treatment was delayed by one or two division cycles. The total frequency of auxotrophs due to both the zero point and delayed mutations, however, is still considerably lower than the frequency of auxotrophs induced by a prolonged treatment of EMS in some bacterial species. Both the prolonged and short EMS treatment induces in yeast also extranuclear respiration-deficient (RD) mutants at a relatively high frequency; in wild strains at equal survival level the prolonged treatment produces a higher number of RD mutants than the short one. In strain that is more susceptible to the lethal EMS effect than wild strain the number of RD mutants produced by the agent is much higher than in the wild strain. The results support the assumption of the different DNA arrangement in yeast nuclei and mitochondria and indicate the possible effect of repair mechanisms during the induction of mutations causing the respiration deficiency. (auth)

**592** NONRADIOACTIVE PREPARATION APPLICATOR FOR RADIOACTIVE SOURCES USED IN UTERO-VAGINAL RADIOTHERAPEUTIC APPLICATIONS. Rocoplan, J. A.; Delonche, G. (to Commissariat a l'Energie Atomique). French Patent 2,147,769. 27 Apr 1971. 7p. (In French).

A nonradioactive method of preparation is presented for gynecological radiotherapy that involves the separation of the positioning of the applicators and probes and colpostats from that of the radioactive sources in these applicators. The applicator consists, essentially, of a uterine probe and two vaginal probes or colpostats connected together with a fixing part during application. The uterine probe and the vaginal probes are contained in radiosterilizable plastic tubes. (FR)

**593** INFLUENCE OF VARIOUS PRETREATMENTS ON THE SEDIMENTATION PROFILES OF THE NEWLY SYNTHESIZED DNA AFTER UV IRRADIATION. Slezarikova, V.; Sedliakova, M. (Cancer Research Inst., Bratislava). Stud. Biophys.; 36-37: 113-120(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Some pretreatments that inhibit DNA synthesis before ultraviolet irradiation simultaneously inhibit the excision number of surviving bacteria. Results of the influence of such pretreatments on the sedimentation profiles of the newly synthesized DNA after irradiation in the strains of Escherichia coli B/+r thy$^-$ trp$^-$ Hcr$^+$ and Hcr$^-$ are presented. Pretreated Hcr$^+$ cells were able to produce normal sized DNA after 90 minutes postincubation, while the Hcr$^-$ cells were unable to do so, though the amounts of unexcised dimers were closely related to one another. (auth)

**594** MUTAGENESIS BY UV IRRADIATION AND N-METHYL-N'-NITRO-N-NITROSOGUANIDINE IN STREPTOMYCES AUREOFACIENS. Blumauerova, M.; Hostalek, Z.; Vanek, Z. (Inst. of Microbiology, Prague). Stud. Biophys.; 36-37: 311-318(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

Quantitative variability in chlortetracycline and tetracycline production in Streptomyces aureofaciens was compared following uv, x, and gamma irradiation and treatment with nitrogen mustard and N-methyl-N'-nitro-N-nitroso-guanidine. The maximum frequency of higher-producing variants was obtained following uv irradiation. Tables are presented to show effects of mutagens on biosynthesis of secondary metabolites, frequency of spontaneous auxotrophic mutants and auxotrophic mutants induced by MNG and uv radiation, relation between auxotroph frequencies and lethal effects of uv light and MNG, and frequencies of spontaneous and uv- and MNG- induced streptomycin-resistant mutants. (HLW)

**595** PROPERTIES OF VIRUS ASSOCIATED WITH SUBACUTE MYELO-OPTICO-NEUROPATHY. Nishibe, Y.; Kimura, T.; Inoue, Y. K. (Kyoto Univ.). Arch. Gesam. Virusforsch.; 40: 189-197(1973).

The virus associated with subacute myelo-optico-neuropathy (S. M. O. N.) produced a weak and incomplete cytopathic effect (CPE) in BAT-6 cells but not in other cells so far tested. However, the virus multiplied in human diploid cells without CPE. The virus passed a membrane filter of 220 nm average pore-size but not one of 100 nm. The virus was sensitive to ether and 5-fluoro-2'-deoxyuridine, and was inactivated by ultraviolet irradiation. Furthermore, the virus was considered to contain DNA since it was labelled by $^3$H-thymidine but not by uridine. The buoyant density of the virus was 1.21 to 1.22 g/ml in CsCl. This agent seems to be a new neuropathic slow virus. (auth)

**596** MUTAGENIC EFFECTS OF GAMMA RAYS ON A PSEUDOMONAS AERUGINOSA STRAIN. D'Empaire, M. O.; Ola, F. N. (Univ., Buenos Aires). Rev. Latinoamer. Microbiol. Parasitol.; 14: 165-171(1972). (In Spanish).

The biochemical and anantigenic behavior of Pseudomonas aeruginosa strain is analyzed in connection with stable mutation recuperated after the irradiation in phosphate buffer at pH 7, with a dose of 800,000 rad using a source of $^{60}$Co. The following results are obtained: the strain of Pseudomonas aeruginosa irradiated in the above conditions suffered variations with relations to primitive strain. The essential variations are in morphology and size of the colonies, decrease of pigmentation, increase of sensibility facing some antibiotics and piocins; the somatic antigenicity however remains unalterable. (auth)

**597** COMPARATIVE STUDY OF THE MUTAGENETIC EFFECT OF UV RADIATION AND DIETHYL SULFATE VAPORS ON STRAIN 1321 OF ACTINOMYCES ANTOCYANEUS. Alieva, R. M.; Shigaeva, M. Kh. Tr. Inst. Mikrobiol. Virusol., Akad. Nauk Kaz. SSR; 15: 19-23(1970). (In Russian).

A comparative study was made of the effects of uv irradiation and diethyl sulfate vapors on the frequency of the origin of different types of mutation in strain 1321 of A. antocyaneus. Of the two mutagens used, diethyl sulfate vapors appeared very effective in the proportion of new types of morphological mutations. Treatment with it caused greater variability with respect to indications of antibiotic formation with a larger yield of the "plus" variant than with uv irradiation. Twelve biochemical mutants induced by uv irradiation and nine biochemical mutants under the effects of diethyl sulfate vapor were selected. The majority of the biochemical mutants proved to be instable and reverted to the original prototrophic state. (tr-auth)

**598** PROCESS FOR PRESERVING FRESH FISH ON FISHING BOATS BY IONIZING RADIATION. Bagge, E.; Woelker, H. German Patent 1,926,377. 3 Dec 1970. Filed date 23 May 1969. (In German).

A process for preservation of fresh fish on a fishing boat by means of ionizing radiation is described. The fresh fish on the fishing boat is subjected, immediately after being caught either whole or as fillets, to strong radiation of short duration. It is then packaged under vacuum and placed in refrigerated storage on the ship and irradiated for a long time with strong gamma radiation. (EJH)

## Radiation Effects on Plants

*Refer also to abstracts 118, 678, and 737.*

**599** INFLUENCE OF FRACTIONATION OF DOSE ON CYTOGENETICAL EFFECT OF FAST NEUTRONS IN ROOT TIP MERISTEM OF CREPIS CAPILLARIS. Kavats, G. E.; Dishler, V. Ya. (Inst. of Biology, Riga). Latv. PSR Zinat. Akad. Vestis; No. 7, 37-41(1973). (In Russian).

Some results obtained after irradiating the seedlings of Crepis capillaris with fast neutrons in doses of 24, 45, and 65 rad and fractionated doses of 10 + 15, 10 + 35, and 10 + 55 rad with intervals between the fractions of 1, 2, 3, and 5 hours show that the effect of fractionation can be observed at the doses of 10 + 15 and 10 + 35 rad beginning with the interval of 2 hours and more, mainly on the one-hit chromosome aberrations. The presence of inhibitors of metabolism (chloramphenicol, 5′fluorouracil, 2,4-dinitrophenol, aurantin) does not influence the effect of fractionation. It is assumed that the effect of fractionation depends on the action of endogenic protection systems neutralizing the destructive action of radiotoxins prior to potential damages of chromosomes. (auth)

**600** EVIDENCE FOR DE NOVO SYNTHESIS OF ASPARAGINE SYNTHETASE IN GAMMA-IRRADIATED POTATOES. Nair, P. M.; Screenivasan, A. (Bhabha Atomic Research, Centre, Bombay). Indian J. Biochem. Biophys.; 8: No. 4, 204-209(Dec 1971).

A ten-fold increase in asparagine synthetase (EC 6.3.1.1) activity was obtained in the bud tissue within 5 hr after 10 krad gamma irradiation. This was followed by a rapid fall in this activity. Irradiated buds also showed an increased incorporation of $^{14}$C-leucine into their soluble protein during this period. Cycloheximide (5 $\mu$g/ml) and puromycin (25 $\mu$g/ml) inhibited this protein synthesis as well as enzyme activation to about 70 and 60%, respectively. Actinomycin D (10 $\mu$g/ml) inhibited protein synthesis in irradiated buds to 70%, while no inhibition was observed with unirradiated buds. The enhancement of asparagine synthetase activity was also arrested to about 70% by actinomycin D. Purified asparagine synthetase showed a single band on polyacrylamide gel electrophoresis. A good correlation was obtained between the incorporation of $^{14}$C–leucine into the enzyme fraction and increase in specific activity. (auth)

**601** INFLUENCE OF IONIZING RADIATION ON THE FERTILITY AND FREQUENCY OF CHROMOSOME ABERRATIONS IN THE MEIOTIC CELLS OF BARLEY. Dishler, V. Ya.; Filipeka, V. F.; Nagle, E. F. (Inst. of Biology, Riga). Latv. PSR Zinat. Akad. Vestis; No. 7, 42-46(1973). (In Russian).

The effect of different doses of $\gamma$ rays and fast neutrons on the plant fertility and frequency of cytogenetic delay in the meiotic cells of barley after seed treatment was investigated. The increase in the fast neutron dose (0.05 to 8 krad) caused a lineary increase in frequency of semisterile plants. No considerable influence of the $\gamma$ dose level on the frequency of semisterile plants was observed. The number of cytogenetically damaged cells at prophase-metaphase I reached 9.1 to 19.9%, and 0.2 to 2.9% were reached at anaphase I. A very high variability between the plants in the frequency of cytogenetically damaged meiotic cells was observed. In general, fast neutrons induced a relatively high frequency of large chromosome translocations. (auth)

**602** ADAPTATION AND EVOLUTION IN IRRADIATED SYNTHETIC POPULATIONS OF ARABIDOPSIS THALIANA. I. Response of $M_1$ and $M_2$ Plants to Irradiation. Dishler, V. Ya.; Rashal, I. D. (Inst. of Biology, Riga). Latv. PSR Zinat. Akad. Vestis; No. 7, 24-28(1973). (In Russian).

The results of analyses of variability of quantitative traits and race composition are reported for the first two generations in synthetic populations of Arabidopsis thaliana, composed of a mixture of 3 races, and exposed to irradiation with $\gamma$ rays and fast neutrons. In the first generation ($M_1$) the delay of plant growth and development was observed. In the second generation ($M_2$), in populations without or with irradiation at small doses, the prevailing race turned out to be the more fertile wild form Enkheim, while in populations with higher doses of irradiation the most radiation-resistant race turned out to the vc'er. The realized heritability of plant height did not exceed that of the control population, but the heritability of number of internodes was higher. (auth)

**603** SENSITIVITY OF BARLEY AND OAT VARIETIES TO FAST NEUTRONS. Kavats, G. E. (Inst. of Biology, Riga). Latv. PSR Zinat. Akad. Vestis; No. 7, 29-31(1973). (In Russian).

Three varieties of barley and three varieties of oats markedly differ in the sensitivity of their seeds to irradiation with fast neutrons. The degree of differences depends on the degree of destruction: the more a certain feature is suppressed, the more this feature differs in its sensitivity as regards fast neutrons. (auth)

**604** USE OF IONIZING RADIATION AND CHEMICAL MUTAGENES TO OBTAIN MUTATION OF SPRING BARLEY. Filipeka, V. F.; Mozhaeva, V. S. (Inst. of Biology, Riga). Latv. PSR Zinat. Akad. Vestis; No. 7, 32-36(1973). (In Russian).

Seeds of two varieties of spring barley of hybrid and non-hybrid origin were treated with $\gamma$ rays in 6.5 and 3 kR doses, fast neutrons of 450, 400, and 300 rad, and chemical mutagenes (N-nitrosoethylurea (NEU) in concentration of 0.05, 0.025, 0.0125% and ethylmetansulphonate (EMS) in concentrations of 0.25, 0.02, 0.1%). The effect of mutagenes in $M_2$ and $M_3$ generations was investigated. The most effective mutagenes proved to be NEU and $\gamma$ rays; the fast neutrons and EMS were less effective. The two-rowed variety L-1150 was more mutable and the six-rowed variety Vairogs, less so. It was established that the variability spectrum depends on the concentration of mutagene and the variety peculiarities. With an increase in the dose and concentration of mutagenes the variability spectrum extends. Forms with large ears, short stalks, soft awns, and fast-ripening ability were obtained. (auth)

**605** EFFECT OF COBALT-60 GAMMA RAYS ON THE STORAGE BEHAVIOUR OF GARLIC BULBS AT ROOM TEMPERATURE AND IN COLD STORAGE. Habibunnisa; Mathur, P. B.; Bano, Z. (Central Food Tech. Research Inst., Mysore, India). Indian Food Packer; 25: No. 6, 10-13(Nov 1971).

Effect of cobalt-60 gamma rays at a dose-rate of 6 krad on the storage behavior of garlic bulbs packaged individually and in lots of eight in perforated polyethylene bags of 200 gauge was investigated at room temperature (75 to 90°F) and cold temperature (32 to 35°F) under relative humidity 85 to 90%. Irradiation was immediately followed by an increase in the rate of respiration in the garlic bulbs followed by a decrease in the rate of respiration towards the later part of the storage period. At room temperature, sprouting was inhibited to a considerable extent, while in cold storage after a storage period of 9 months sprouting was completely prevented. The percentage sprouting was more in large size garlic bulbs than in small sized ones. For extension of storage life, packaging singly in polyethylene bags, selection of small sized garlic bulbs, storage at 32 to 35°F and irradiation with 6 krad of cobalt 60 gamma rays are recommended. (INIS)

**606** RELATIONSHIP BETWEEN THE OBSERVED X-RAY INDUCED CHROMOSOME ABERRATION FREQUENCY AND THE EVENTS OF MEIOSIS IN LILIUM LONGIFLORUM. Shull, J. K. Tallahassee, FL; Florida State Univ. (1973). 130p. University Microfilms Order No. 73-21,355.

Thesis (Ph. D.).

Meiotic synchrony in microsporocytes of Lilium longiflorum var. "Croft" was re-examined, and the relationship between the formation and dissolution of the synaptinemal complex with variations in apparent sensitivity to x-ray induced chromosome damage was studied. Earlier reports of a gradation from early states in the base to late stages in the apex were confirmed. The sporogenous tissue development was found to be synchronous at any given level between locules of the same anther and anthers of the same bud prior to late diplotene. The assumption of meiotic synchrony between buds of the same length was found to be invalid. A method was proposed to quantify the progress of meiosis by obtaining relative numbers of the components of the synaptinemal complex. Most synapsis is completed within a 19 hour period in the late afternoon and night. To compare the progress of the synaptinemal complex with the variation in apparent x-ray sensitivity of the chromosomes, buds of L. longiflorum were irradiated at various stages of meiosis and samples were immediately taken for staging with the light and electron microscopes. Chromosome breaks induced by the irradiation were scored at anaphase I and anaphase II. The number of observed aberrations decreased until leptotene-zygotene and increased during zygotene to pachytene. Reduction of observed aberrations corresponded to the first appearance of the axial cores, and the increase corresponded to the time that the synaptinemal Cortex was completing formation. (Diss. Abstr.)

**607** EFFECTS OF MICROBEAM IRRADIATIONS ON THE MICROSPOROCYTES AND MICROSPORES OF TRADESCANTIA PALUDOSA. III. Preliminary Note on the Effects of Ultraviolet Microbeam Irradiations. Garot, G.; Dujardin, M.; Gilles, A. (Univ. Catholique, Louvain, Belgium). Can. J. Genet. Cytol.; 15: No. 1, 39-44(Mar 1973). (In French).

Microsporocytes of Tradescantia paludosa were irradiated with ultraviolet microbeams of 2 to 10 microns. At a wavelength of 2570 A, a selective destruction, total or partial, of the spindle in the first division, anaphase bridges, and interruption in the second division were observed. At a wavelength of 2750 A, the most remarkable effect is the "paling" of some parts of the chromosome structure as well as of interphase nuclei, and also stickiness bridges in the bivalents of the first division. (auth)

**608** INDUCTION OF SPORULATION OF FUNGI ISOLATED FROM DACTYLIS GLOMERATA SEED BY EXPOSURE TO NEAR-ULTRAVIOLET RADIATION. Leach, C. M.; Tulloch, M. (Oregon State Univ., Corvallis). Ann. Appl. Biol.; 72: No. 2, 155-159(Oct 1972).

Pure cultures of 52 species of plant pathogenic and saprophytic fungi isolated from orchard (cock's-foot) grass seed (Dactylis glomerata L.) were incubated either in total darkness or exposed to a diurnal cycle of near-ultraviolet (NUV) radiation (12 h NUV/12 h darkness). Twenty-four species sporulated only after exposure to NUV including seven species of Drechslera, five species of Fusarium, as well as species of Ascochyta, Phoma, Septoria, Pyrenochaeta, Rhynchophoma, and Stagonospora; six species sporulated moderately in darkness but more profusely following exposure to NUV; twenty species sporulated whether they were irradiated or not; and only two species failed to sporulate. To assess the pathogenic fungal microflora of orchard grass seed accurately, seeds should be incubated under a daily regime that includes NUV to induce sporulation. (auth)

**609** INDUCED CUP-LEAF MUTANT IN BRASSICA CAMPESTRIS VAR. BROWN SARSON. Kumar, P. R.; Dias, z. (Banaras Hindu Univ., IN). Indian J. Genet. Plant Breed.; 31: No. 3, 556-558(Nov 1971).

Following exposure of seeds of groundnuts (Brassica campestris) to 20,000 R of gamma radiation, mutants with cup-shaped leaves were observed in the $M_2$ generation. During meiosis multivalent associations and other obnormalities of chromosomes were also observed. (HLW)

**610** POLYGENIC VARIATION FOLLOWING IRRADIATION IN INTERSPECIFIC CROSSES OF COTTON. Siddiqui, J. A. (Indian Agricultural Research Inst., New Delhi). Indian J. Genet. Plant Breed.; 31: No. 3, 461-470(Nov 1971).

The possibility of widening the spectrum of recombination through $F_1$ seed irradiation was studied. $F_1$ seeds of the crosses between Gossypium arboreum and G. herbaceum and between G. hirsutum and G. barbadense were exposed to an acute dose of $^{60}$Co $\gamma$ rays. A comparative assessment was made of the variability occurring in the regular $F_2$ progenies and in the progenies derived from irradiated $F_1$ plants. The range of the distribution of plot means was invariably wider in the treated population for almost all the characters in comparison to their respective controls. The analysis of variance showed higher values for all the characters in the treated populations as compared to control. However, the precise effect of radiation in inducing variability varied from character to character. Data on the coefficient of genetic variability showed in general increased values in the irradiated diploid and tetraploid crosses, but the magnitude of variability was considerably higher in the former than in the latter. Scope for selection thus exists. The increased variability has mainly been attributed to micro-mutations. However, the occurrence of rare types of segregants for several important characters supports the possible role played by recombinations at meiotic and somatic levels. (auth)

**611** EFFECT OF FAST ELECTRONS WITH DIFFERENT ENERGY SPECTRA ON TWO DNA FRACTIONS OF MERISTEMATIC CELLS. Elmshaeuser, H. J.; Markus, B. (Univ., Goettingen, Ger.). Biophysik; 10: No. 2, 157-162(1973). (In German).

In previous observations of the frequency of chromosome aberrations in anaphase meristem cells of Allium cepa irradiated with fast electrons in different depths the varying radiosensitivity in different stages of the cell cycle could be interpreted by assuming a different effect in euchromatin and heterochromatin synthesized at different times. In the experiments described two DNA fractions of different molecular weight extracted from the same object and from Vicia faba and defined as euchromatin and heterochromatin by the uptake of $^3$H-actinomycin D have been irradiated under the same conditions. The change in UV absorption after surface and depth irradiation was different for the two chromatin fractions and can be explained in accordance with the chromosome aberrations by repair of euchromatin, but not of heterochromatin, 9 h after irradiation. (auth)

**612** SENSITIVITY TO MUTAGENS OF RUMEX ACETOSA CHROMOSOMES. Degaraeve, N.; Moutschen, J. (Univ., Liege). Experientia; 29: No. 8, 1026-1027(15 Aug 1973).

Seeds of Rumex acetosa were exposed to 100 to 3000 rads of $^{60}$Co gamma radiation, methyl methane sulfonate (MMS), or methyl nitroso urea (MNU). The spectrum of different chromosomal aberrations was found to be different after the use of each mutagen. MNU was more effective than MMS in producing chromosomal aberrations. Male cells were more sensitive than female, and the sex chromosomes were more sensitive to the chemical mutagens. (HLW)

**613** CONCENTRATION OF OAK APHIDS, MYZOCALLIS spp., ON IRRADIATED WHITE OAKS. Hinckley, A. D. (Brookhaven National Lab., Upton, NY). Environ. Entomol.; 2: No. 4, 697-700(Aug 1973).

In two gradients of gamma irradiation at Brookhaven National Laboratory, white oaks exposed to 10 to 30 R per 20-hr day are retarded in leafing out. From June 9 to 13, 1969, these oaks under radiation stress were colonized by alate aphids, 61 ± 11 (mean ± Standard Error) Myzocallis tuberculata Richards 13 ± 7 M. discolor (Monell) per 100 leaves. The alates were apparently attracted by the yellowish hue of the retarded foliage, and the initial concentration led to high aphid densities, 500 to 1600 per 100 leaves, during late June and early July. (auth)

**614** EFFECT OF X RADIATION ON SOME ASPECTS OF PLANT METABOLISM UNDER CONDITIONS OF SUBSTRATE SALINIZATION. Prikhod'ko, L. S.; Klyshev, L. K. Tr. Inst. Bot., Akad. Nauk Kaz. SSR; 29: 86-95(1971). (In Russian).

Preliminary data are presented on the positive role of moderate x irradiation of seeds on the salt stability of plants. This was expressed in the very equalized growth of the plants from irradiated seeds and less sharp change of their carbohydrate and nitrogen exchange in the NaCl background. The impression was that irradiation inhibits the process of the fluctuation of the metabolism of plants under conditions of salinization approaching it in the metabolism of control plants. (tr-auth)

**615** FAST REJOINING PROCESSES IN NIGELLA DAMASCENA CHROMOSOMES REVEALED BY FRACTIONATED $^{60}$Co $\gamma$-RAY EXPOSURES. Gilot-Delhalle, J.; Thakare, R.; Moutschen, J. (Univ., Liege). Radiat. Bot.; 13: No. 4, 229-242(Aug 1973).

Dry seeds of Nigella damascena were irradiated by $^{60}$Co $\gamma$ rays with fractionated exposures (2 × 4 krads), separated by time-intervals ranging from 2 to 3 min with increments of 10 sec. At time-intervals longer than 2 min 10 sec, the frequency of chromosome aberrations was found to be considerably decreased. These fast rejoining processes were oxygen dependent, being suppressed under anoxic conditions. Similarly, respiratory inhibitors: potassium cyanide ($1 \times 10^{-4}$ M), sodium azide ($1 \times 10^{-4}$ M), and dinitrophenol ($1 \times 10^{-5}$ M) suppress the decrease. To test the hypothesis that ionic bonds can be involved in fast rejoining processes, seeds were treated respectively with three chelating agents (at $1 \times 10^{-4}$ M) before irradiation. Dipyridyl (DP) was found to suppress the decrease whereas diethyldithiocarbamate (DIECA) or cupferron (CUPF) produced a reversion at exactly the same time-interval. The action of chelating agents was proved to be oxygen dependent. It was also demonstrated that all kinds of aberrations of the chromosome class i.e. breaks, minutes, dicentrics, or rings were involved in the processes. (auth)

**616** CYTOGENETICS OF TWO GAMMA-IRRADIATED BARLEY LINES IN $M_4$ GENERATION. Sen Singh, I. (Banaras Hindu Univ., India). Radiat. Bot.; 13: No. 4, 207-209(Aug 1973).

Seeds from gamma-irradiated (40 kR) heterozygous lines of barley were taken from $M_3$ plants and grown in the field as $M_4$ lines. Meiotic study of partially sterile plants of two $M_4$ lines showed reciprocal translocation. The frequency of ring-of-4 formation in these lines showed a positive relationship with the sterility. In line 1666, a high frequency of the translocation rings showed attachment to the nucleolus. Since chromosomes 6 and 7 of barley are satellited and remain attached to the nucleolus, it is concluded that chromosomes 6 and 7 are involved in this reciprocal translocation. (auth)

**617** MUTATIONS IN PLANTS. Srivastava, H. K. (Haryana Agricultural Univ., Hissar, India). Sci. Rep.; 10: No. 5, 209-212 (May 1973).

The molecular mechanisms of mutagenesis and its role in plant improvement are emphasized. Different types of mutation processes are described. Special reference is made to radiation mutagenesis and chemical mutagenesis. Mutant organisms are indispensable tools for the science of genetics. Induced mutations, either through radiation mutagenesis or chemical mutagenesis can be used to generate useful variation in polygenic characters such as yield, adaptability, maturity time, and numerous other traits specially in useful crops. It is observed that mutagenesis in plants may, in addition to increasing yield, offer new ways of overcoming various limitations associated with the cultivation of an agronimically superior variety. (INIS)

**618** UTILITY OF INDUCED MUTATIONS IN PLANT BREEDING. Ram, Mahabal, Fasih-uz-Zaman. (Indian Agricultural Research Inst., New Delhi). Indian J. Agr. Sci.; 42: No. 12, 1087-1091(Dec 1972).

Inheritance of plant height in three exotic semi-dwarf rice varieties (Oryza sativa L.) viz., Taichung Native 1, IR 8, and Dee-geo-woo-geu with plant height of 80 to 90 cm, and NP 130, an artifically radiation induced dwarf mutant of Indian origin with plant height of 85 to 90 cm, was studied. The study indicated that two pairs of additive genes with cumulative gene effect control this character. The twisted appearance of leaf in NP 130 is controlled by two pairs of recessive duplicate genes, whereas the normal leaf shape was found dominant over the twisted one. The grass clump, which was observed only in the $F_2$ population was controlled by one pair of dominant genes along with a pair of inhibitory genes. Study on inheritance of these plant characters was made to collect information on the nature of gene action that control these characters, as well as to assess the economic activity of these newly released hidden genetic variabilities in plant type. (INIS)

## Radiation Effects on Animals

*Refer also to abstract 2362.*

**619** (CONF-710567–, pp 21-29, PAPER 3) DOSE EQUIVALENT, RBE AND QF. Kapoor, K. K. Aug 1971.

From seminar on recommendations of the international commission on radiological protection; New Delhi, India (12 May 1971).

Radiation units used in radiation protection are defined in accord with ICRU recommendations made during the period 1962 to 1966. The units discussed include: radiation absorbed dose, dose equivalent (DE), dose rate, rad, rem, quality factor (QF), linear energy transfer (LET), and relative biological effectiveness (RBE). The validity of the definitions are discussed on the basis of experimental data, with emphasis on the relation of QF to RBE. Applications in expressing risk-limiting effects or maximum permissible dose of acute or chronic external or internal exposure of various organs, tissues, and organisms are considered in relation to possible genetic or somatic effects manifested at various times following exposure to $\alpha$, $\beta$, $\gamma$, x, neutrons, protons, or heavy charged particles of various energies are energies. (CH)

### Man

*Refer also to abstracts 217, 362, 392, 545, 783, 2324, 2325, and 2329.*

**620** BREAST CANCER ASSOCIATED WITH REPEATED FLUOROSCOPY. Grundy, G. W. (National Cancer Inst., Bethesda, MD); Uzman, B. G. J. Nat. Cancer Inst.; 51: No. 4, 1339-1340(Oct 1973).

Preliminary data suggested that increased breast cancer risk among women under age 50 in an Arkansas community may have been related to repeated fluoroscopy at a local tuberculosis sanatorium. (auth)

**621** SYNTHESIS AND PRELIMINARY EVALUATION IN ANIMALS OF CARRIER-FREE $^{11}$C-1-DOPAMINE HYDROCHLORIDE. X. Fowler, J. S.; Ansari, A. N.; Atkins, H. L.; Bradley-Moore, P. R.; MacGregor, R. R.; Wolf, A. P. (Brookhaven National Lab., Upton, NY). J. Nucl. Med.; 14: No. 11, 867-869(Nov 1973).

Carrier-free $^{11}$C-labeled dopamine hydrochloride was synthesized using carrier-free H$^{11}$CN as a precursor. Tissue distribution studies on five dogs showed a specific localization in the adrenal medulla. Tissue distribution studies with $^{11}$C-labeled noradrenaline are in progress. (auth)

**622** RADIATION RISK IN PREGNANCY. Sternberg, J. (Univ. of Montreal). Clin. Obstet. Gynecol.; 16: 235-278(Mar 1973).

Data on the hazards of radiation for the human fetus are reviewed for the benefit of physicians who must take a calculated risk by exposing pregnant women to radiation during diagnostic or therapeutic procedures. The radiosensitivity of the various developmental stages, the comparative hazards of external and internal exposure, and relationship of radiation dose to the damage that may result are considered, as are alternative procedures that may be considered for the well-being of the mother. Data are summarized from a number of studies on experimental animals on which some of the conclusions are based. (23 references) (CH)

**623** (CONF-710567–) RECOMMENDATIONS OF THE INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION. Proceedings of the Seminar Held at New Delhi, May 12, 1971. (Institute of Nuclear Medicine and Allied Sciences, Delhi (India); All India Inst. of Medical Sciences, New Delhi). Aug 1971. 193p.

Separate abstracts were prepared for 13 papers presented at this seminar. Two additional papers were given on the ICRP organization and activities and evolution of ICRP recommendations. (CH)

*For abstracts of individual papers see: 371, 619, 624–631, 782, 783, and 800.*

**624** (CONF-710567–, pp 72-75, PAPER 6) GENERAL PRINCIPLES FOR OPERATIONAL RADIATION PROTECTION. Jain, M. P. Aug 1971.

From seminar on recommendations of the international commission on radiological protection; New Delhi, India (12 May 1971).

Recommendations of the ICRP for the radiation protection of occupationally exposed personnel are discussed. It is suggested that for administrative purposes personnel should be identified as those whose annual doses might exceed three-tenths of the annual maximum permissible dose and who should be subjected to individual monitoring of both external and internal exposure, and those exposed to work conditions that are unlikely to result in doses of three-tenths of the annual permissible dose, for whom monitoring of the work environment should be sufficient. It is pointed out that records of personal doses, accidental exposures, and medical examinations should be kept for all personnel. (CH)

**625** (CONF-710567–, pp 76-91, PAPER 7) PROTECTION AGAINST IONISING RADIATION FROM EXTERNAL SOURCES. Bhola, G. C. Aug 1971.

From seminar on recommendations of the international commission on radiological protection; New Delhi, India (12 May 1971).

The 1969 recommendations of the ICRP for protection against external sources of ionizing radiation are reviewed. Radiation source design and operation and radiation monitoring are considered briefly. Protective methods for personnel using x-ray sources, particle accelerators, radiation beam equipment ($\gamma$ and x) with sealed sources, and sealed sources without beam collimation for therapy, industrial uses, and research are outlined. Emphasis is placed on the protection of patients during diagnostic radiography. (CH)

**626** (CONF-710567–, pp 92-99, PAPER 8) MONITORING FOR RADIATION PROTECTION OF WORKERS. Jain, M. P. Aug 1971.

From seminar on recommendations of the international commission on radiological protection; New Delhi, India (12 May 1971).

Recommendations of the ICRP published in 1969 for the monitoring of the environment for the radiation protection of miners and other personnel are summarized and critically examined. For the correlation of surface contamination and/or excretion analysis with organ doses, a concept of derived working limit (DWL) was developed and used. The DWL postulates appropriate models of exposure pathways, and can be used to establish a level of environmental radioactivity below which three-tenths of the maximum permissible dose will not be exceeded. Whenever levels of radioactivity in air or on surfaces approach the maximum permissible level special individual monitoring programs to measure skin contamination and internal contamination, based on urine analysis and/or whole-body counting, should be instigated. (CH)

**627** (CONF-710567–, pp 112-132, PAPER 11) SOMATIC EFFECTS OF RADIATION. Rammohan, L. Aug 1971.

From seminar on recommendations of the international commission on radiological protection; New Delhi, India (12 May 1971).

Data presented in ICRU Publications numbers 8 and 14 on the somatic effects of ionizing radiations on mammals are reviewed. The data on humans are based on observations on residents of Hiroshima and Nagasaki exposed to atomic bomb explosions; patients following radiotherapy of ankylosing spondylitics; radiologists exposed occupationally; infants and children exposed as fetuses during diagnostic radiography or radiotherapy of the pregnant mother; infants and children exposed during radiotherapy; and persons taking up $^{226}$Ra during occupational uses or diagnostic tests. The relationship observed between radiation dose and LET and the development of cataracts; impaired fertility; and bone marrow damage in humans is discussed. Data from studies on a number of mammalian species have given evidence of radioinduced developmental abnormalities, life shortening, and neoplasms. (CH)

**628** (CONF-710567–, pp 133-138, PAPER 12) GENETIC EFFECTS OF RADIATION. Nagaratnam, A. Aug 1971.

From seminar on recommendations of the international commission on radiological protection; New Delhi, India (12 May 1971).

Data presented in the 1966 ICRP report on the genetic effects of radiation are summarized and discussed. It is pointed out that there is very little direct evidence concerning the genetic effects of radiation on man, and that most of the information available is the result of extrapolation from studies on effects on laboratory mammals. The evidence indicates that: increased radiation exposure will increase the frequency of certain diseases and disabilities of genetic origin that are already present, but will not introduce any new type of change; dose response relationship is linear, with no threshold; injury to germ cells must take place during the premitotic stage, which may extend over a period of six to eight weeks in sperm but only a few days in oocytes. It is postulated that the vast majority of radioinduced mutations are harmful to some degree, and that they are most likely to be recessive. Abnormalities observed in irradiated animals include death of embryos and fetuses, still-births, neonatal death, and various degrees of teratogenesis. (CH)

**629** (CONF-710567-, pp 139-146 PAPER 13) EVALUATION OF RISKS FROM RADIATION. Nagaratnam, A. Aug 1971.

From seminar on recommendations of the international commission on radiological protection; New Delhi, India (12 May 1971).

Data presented in the ICRP publication number eight, issued in 1966 concerning the evaluation of risks from radiation for human populations are summarized and discussed. Estimates are presented of genetic and somatic effects of chronic exposure to a dose of one Rad over a period of 10 to 20 years. The genetic risks to the first generation and to later generations are considered. The increased incidence of malignancies is the only somatic effect likely to be observed following chronic exposure to this low dose of radiation. The risk would be increased should fetuses be exposed. It is concluded that the effects of chronic exposure to a few rads of radiation would not be detected in the annual statistical analysis of a population of 50 million. The limitations of existing methods of risk evaluation are pointed out and the implications of these limitations for use in establishing maximum permissible radiation dose levels for human populations are discussed. (CH)

**630** (CONF-710567-, pp 147-150, PAPER 14) RADIOBIOLOGICAL ASPECTS OF SUPERSONIC TRANSPORT. Jain, S. C. Aug 1971.

From seminar on recommendations of the international commission on radiological protection; New Delhi, India (12 May 1971).

Radiation from extraterrestrial sources, or cosmic rays is of two types, namely, galactic radiation and solar radiation. Galatic radiation is derived from sources other than the sun and impinges continually on the earth's atmosphere. Solar radiation is received intermittently from solar flares associated with sun spots. These radiations increase in intensity with altitude and geomagnetic latitude. The radiation dose to passengers during supersonic flight was estimated, assuming an average of 12 flight hours per year per passenger with the entire time being spent at 80,000 ft. The average exposure per passenger per year will not exceed 30 mrem, provided there is no major solar flare during the flight time. This exposure is well below the ICRP's recommended maximum permissible dose of 500 mrem/yr for individual members of the public. The source of uncertainties in the estimates of exposure are pointed out. (CH)

**631** (CONF-710567-, pp 151-153, PAPER 15) RADIATION PROTECTION IN SCHOOLS. Jain, M. P. Aug 1971.

From seminar on recommendations of the international commission on radiological protection; New Delhi, India (12 May 1971).

In view of increasing inclusion in the school curricula of experiments and instruction using sources of ionizing radiations, the Committee 3 of the International Commission on Radiological Protection (ICRP) set up a Task Group in 1966 to make recommendations for radiation protection of school pupils of age below 18. The recommendations are discussed. The recommendations seek to achieve a situation whereby the annual dose received by individual pupils in the courses under consideration will not exceed one-tenth of the dose limits recommended for individual members of the public. Safe working procedures with radiation sources are given. Special recommendations are made about transport, storage, locking arrangements, warning symbols in case of x-ray apparatus, sealed sources, and unsealed radioisotope sources. (INIS)

**632** (LA-UR-73-1389) BIOLOGICAL EFFECTS OF NEGATIVE PIONS. Raju, M. R. (Los Alamos Scientific Lab., N. Mex. (USA)). 1973. Contract W-7405-eng-36. 15p. (CONF-731012-2). Dep. NTIS $3.00.

From thirteenth international congress of radiology; Madrid, Spain (15 Oct 1973).

A brief review is presented of studies on biological effects of negative pions. Studies on biological effectiveness at the plateau were conducted using mice with ascites tumors; the RBE relative to $^{60}$Co gamma radiation was nearly 1.0. Studies on biological effectiveness and oxygen enhancement ratio using root growth of Vicia faba showed that the RBE was 1.31 and the OER was 2.04. RBE and OER were measured in various biological systems and the results at the peak of the depth-dose distribution are tabulated. Results of studies on human kidney cells, bean roots, and HeLa cells are reviewed with regard to variations in biological effectiveness within the peak region. Cell survival calculations are reviewed with emphasis on cell survival data at various discrete LET values. A discussion is presented of the biological effects of negative pion beams of interest for therapy. (HLW)

**633** (ORNL-TM-4323) CONTRIBUTION OF NATURAL TERRESTRIAL SOURCES TO THE TOTAL RADIATION DOSE TO MAN. Auxier, J. A.; Christian, D. J.; Jones, T. D.; Kerr, G. D.; Perdue, P. T.; Shinpaugh, W. H.; Thorngate, J. H. (Oak Ridge National Lab., Tenn.). Sep 1973. Contract W-7405-eng-26. 173p. Dep. NTIS $10.75.

Thesis. Submitted by J. A. Auxier to Georgia Inst. of Tech., Atlanta.

The central objective of this research was the analysis and synthesis of data available concerning human exposures to the natural terrestrial radiation environment and the solution of some key problems that appeared to be hampering the understanding of it. A better knowledge of the natural radiation environment appears to be necessary to a realistic interpretation of the effects of low levels (for example, current occupational guide levels) of radiation exposure of man. Specific objectives included a determination of the important parameters affecting radon emanation from concrete, the measurement and correlation of the gamma ray spectra from radionuclides for typical concentrations in soil, a determination of the possibility and practicability of using high resolution spectrometers to measure low levels of radioactive contamination due to human activities, and an evaluation of major sources of external and internal human exposure due to the natural radiation environment. (CH)

**634** SEX CHROMATIN IN THE EPITHELIUM OF THE MUCOSA AND THE VAGINA IN ANTITUMOR THERAPY. Mikhina, Z. P. (Moscow Medical Inst.). Med. Radiol.; 18: No. 8, 63-65(Aug 1973). (In Russian).

Mean indicators of sex chromatin in cells of the mucosa and vagina do not differ before and after radiation therapy, chemotherapy, and ovary excision. All forms of antitumor therapy cause large individual variation of the concentration of sex chromatin in parts of the sick both with decrease and increase of the indicators. With the introduction of sinestrol and prednisolone a significant decrease of the sex chromatin concentration occurs in the epithelium of the mucosa. In all forms of hormonal treatment the concentration of sex chromatin in the vaginal epithelium alters in dependence on the changes of the types of vaginal greasing. The dependences between the reactions of the peripheral blood and the tumor on treatment on the one hand and the oscillations of the sex chromatin indicators in the epithelium of the mucosa and vagina on the other were not established. (tr-auth)

**635** CONDITION OF THE LIVER IN STOMACH CANCER PATIENTS AFTER SURGICAL AND RADIATION SURGICAL THERAPY WITH INTRAPERITONEAL COLLOIDAL $^{198}$Au. Yagorava, G. V. (Scientific Research Inst. of Oncology and Medical Radialogy, Minsk). Vestsi Akad. Navuk BSSR, Ser. Biyal. Navuk; No. 4, 80-83(1973). (In Belorussian).

The protein-formation and pigment functions of the liver and enzyme spectrum of the blood serum were studied in 154 pretherapy patients and in 52 after surgery plus 56 after surgery and radiation. Liver biopsies and pathophysiological hematograms were made. In pretherapy patients there were significant disruption of the functional state and changes in the morphology of the liver. Shortly after treatment the functional state of the liver became worse, especially on the seventh day and more so in patients after gastrectomy and when there were post-therapy complications. Subsequently the functional state tended to improve, but it did not return completely to normal in 21 days. Intraperitoneal administration of 100 to 125 μCi of $^{198}$Au immediately after surgery did not affect the functional state of the liver. (tr-auth)

**636** RELATIVE BIOLOGICAL EFFICACY OF FAST ELECTRONS IN DIFFERENT SECTIONS OF TISSUE-EQUIVALENT PHANTOM. Milyshtein, R. S.; Kuznetsova, L. A. (Moscow Scientific-Research Rentgeno-Radiological Inst.). Med. Radiol.; 18: No. 9, 68-69(Sep 1973). (In Russian).

Results of investigations of relative biological efficacy (RBE) of a beam of electrons with an energy in the phantom of 22 MeV are described for three sections. Relative biological efficacy defined on lysogenic bacteria, within 60% of the isodose, remained constant. (auth)

**637** LYMPHOCYTE RESPONSE AFTER RADIOTHERAPY. Braeman, J. (Velindre Hospital, Whitchurch, Wales). Lancet; No. 7830, 683(22 Sep 1973).

The lymphocyte response of 48 patients with carcinoma of the bronchus was studied before and after radical radiotherapy using phytohemagglutinin (P.H.A.) and pokeweed mitogen (P.W.M.). The absolute lymphocyte-count before and after treatment was also assessed. The patients received an average dose of 3200 rad in eight fractions, given twice weekly over 4 weeks. The average fall in the absolute lymphocyte-count was 50% of the original number. The average proportional drop in the P.H.A. response of the lymphocytes was 45%. The average response of the lymphocytes to P.W.M. was not affected by the treatment. It is suggested that these results indicate that it is the T (thymus-dependent) population of lymphocytes that is affected by treatment with radiotherapy and the B population remains unchanged. (auth)

**638** IRRADIATION TREATMENT OF RHEUMATOID ARTHRITIS. Gumpel, H. M. (Northwith Park Hospital, Harrow, Eng.). Brit. Med. J.; 3: 633(22 Sep 1973).

Brief criticism is made of a previous editorial (Brit. Med. J., Vol. 3 No. 5674 4 Aug. 1973) concerning irradiation treatment of rheumatoid arthritis. Attention is drawn to the omission of references to European literature other than English. The dangers of the $\beta$ emission of $^{90}$Y are mentioned, and it is pointed out that French workers use $^{90}$Y in the knees, $^{186}$Re in other large joints, and $^{169}$Er in finger joints. Mention is made of the emphasis on immobilization of the treated joint, both to reduce chromosome damage and to reduce the extra-articular spread of radiocolloid after injection. (UK)

**639** POSTRADIATION SARCOMA OF BONE. Sim, F. H.; Cupps, R. E.; Dahlin, D. C.; Ivins, J. C. (Mayo Clinic, Rochester, MN). J. Bone Joint Surg.; 54A: No. 7, 1479-1489(Oct 1972).

From annual meeting of American Orthopaedic Association; Hot Springs, Virginia (21 Jun 1971).

Thirty-four additional cases of sarcoma developing in previously irradiated bone are documented, bringing the total Mayo Clinic experience in sarcoma appearing after radiation therapy to fifty-five instances. The sarcomas arose in normal bone within the radiation treatment field in eleven patients, while they arose in pre-existing bone lesions in sixteen patients. Osteogenic sarcoma and fibrosarcoma were most commonly diagnosed. The outlook in tumors of this nature is poor, the average survival being 1.14 years, with only two long-term survivors. Although a relationship has been established in experimental animals, a direct relationship between exposure to external radiation and the development of sarcoma is not established in man. There is no absolute proof that ionizing radiation caused any of these sarcomas. However, this and other significantly large series add to the mounting circumstantial evidence that the association between ionizing radiation and sarcoma is a real one. It must also be emphasized that this is a rare complication clinically. (auth)

**640** RADIUM MENOPAUSE. A Long-Term Follow-up. Bamford, D. S.; Wagman, H. (London Hospital). J. Obstet. Gynaecol. Brit. Commonwealth; 79: No. 1, 82-84(Jan 1972).

Ninety-three patients were traced out of 110 who were treated by induction of a radium menopause in 1950 and 1951. The method was very successful; there were no serious postoperative complications and patients suffered neither recurrence of dysfunctional bleeding nor distressing menopausal symptoms. However seven women subsequently developed malignant tumors and six of these involved the genital tract. The fact that two of these were pelvic sarcomas may support the view that pelvic irradiation promotes the development of sarcoma. This, together with the knowledge that women with abnormal bleeding in the 5th and 6th decades already have an increased risk of uterine malignancy, supports the view that radium menopause should be considered only in the treatment of women who are poor surgical risks. (auth)

**641** X-RAY DOSES DURING FEMUR SHORTENING OSTEOTOMY IN CLOSED OPERATION TECHNIQUE. Fischer, S. (Hamburgisches Krankenhaus Bevensen, Ger.). Chirurg; 44: No. 4, 171-176(1973).

Shortening of the femur in closed operation technique is effected through an incision of the skin approximately 2 cms long and is performed by means of the intramedullary osteotomy developed by Kuentscher, without having to open the site of osteotomy from outside. The whole procedure may be regarded as an advanced development of closed Kuentscher nailing technique. This unorthodox operating technique would not be feasible without x-ray television, as the surgeon has to check the single operating steps on the T.V. monitor. For assessing radiation exposure the dose was measured during the operation performed with the aid of a mobile image intensifier unit. We measured the incident patient dose, the area dose product, and the gonad dose. Whole-body exposure of the operating personnel was also measured. Results were as follows: average incident dose is 50 R with occasional peaks of 100 R. The average area dose product is about 2,000 R cm$^2$ which may be compared with the exposure occurring in fluoroscopy of the stomach. The gonad dose with male and female patients is about 150 mR and 70 mR, respectively. Whole-body exposure of the operating team and the operating personnel does under no circumstances exceed the legally tolerable limits. (auth)

**642** HYGIENIC CHARACTERISTICS OF GENETICALLY SIGNIFICANT DOSES PRODUCED DURING X-RAY EXAMINATIONS. Stavitskii, R. V.; Dermendzhiev, Kh. T. (Central Inst. of Advanced Medicine, Moscow). Gig. Sanit.; No. 8, 48-50(Aug 1973). (In Russian).

A hygienic assessment was made of irradiation protection means to be undertaken under conditions of x-ray examinations obtained by comparison of genetically significant irradiation doses produced in case of different types of examination. (auth)

**643** INDICES OF LEUKOCYTES IN RADIATION TREATMENT OF PATIENTS WITH MALIGNANT TUMORS. Sokolova, I. I.; Volkova, M. A.; Dar'yalova, S. L. (Moscow Scientific Research Oncology Inst.). Med. Radiol.; 18: No. 9, 32-36(Sep 1973). (In Russian).

Study of the dynamics of morphological and functional condition of leukocytes elements in patients who had undergone remote $\gamma$ therapy in the conditions of hyperbaric oxygenation for malignant neoformations of different localization showed that the character of changes of leukocytes was caused by its starting condition. After completing the course of treatment general content of leukocytes was changed insignificantly, the number of macrophages and eosinophils increased, the content of glycogen and activity alkaline phosphatase in neutrophils rose. Relative correlation between the blood's picture and tolerance by the patients of radiation therapy is noted. (auth)

**644** RADIATION-HYGIENIC CONDITION IN INTRACAVITARY $\gamma$ THERAPY OF CERVIX UTERI CANCER. Golikov, V. Ya.; Kostromina, K. N.; Titova, V. A. Med. Radiol.; 18: No. 9, 37-41 (Sep 1973). (In Russian).

A progressive method of intracavitary $\gamma$ therapy according to the principle of afterloading makes it possible to reduce considerably the scope of radiation-dangerous manipulations and the number of medical personnel subjected to ionizing radiation. This makes it possible to better the conditions of radiation safety and cut down economic expenses on protective equipment in radiological institutions. (auth)

**645** RADIATION SECURITY OF MEDICAL PERSONNEL IN DEALING WITH $^{90}$Y. Lyass, F. M.; Korenkov, I. P.; Desyatnikov, V. M. Med. Radiol.; 18: No. 9, 41-45(Sep 1973). (In Russian).

Materials on ensuring the radiation security of medical staff are presented in carrying out radiosurgical intervention with $^{90}$Y introduction into the cellular region. Medical personnel are exposed in realization of roentgenotelevision control over the greatest dose of irradiation in radiosurgical intervention. General irradiation to which the physician is subjected is as an average 7 mr (arms —up to 15 mr), and the nurse up to 4 mr (arms —up to 6 mr) during one radiosurgical intervention. (auth)

**646** CYTOGENETIC INVESTIGATIONS OF THE PERSONS EXPOSED TO IONIZING RADIATION IN SMALL DOSES. Gorizontova, M. N.; Khvatov, V. B. (Inst. of Medical Genetics, Moscow). Med. Radiol.; 18: No. 9, 45-53(Sep 1973). (In Russian).

Persons who were exposed for a long time to occupational irradiation by small doses of ionizing radiation and also those, not having any contact with ionizing radiation, besides usual diagnostical ones, were observed. It was shown that irradiation ($\gamma$ and neutron) in a dose less than 5 rads in a year (as an average 1.1 ± 0.16) with a general dose of external irradiation 12 ± 2.8 rads in the course of 11 to 12 years neither increases the number nor changes the types of chromosome aberrations in comparison with the spontaneous level. Irradiation ($\gamma$ and roentgen) in a dose more than 5 rads in a year (from 6 to 15 rads) with a general dose of external irradiation 125 ± 33 rads in the course of 12.6 ± 3.5 years caused the rise by 2 to 3 times of the content of aberrant cells, affected chromosome aberrations on 100 cells and the frequency of aberrations of chromosome type. Changes on the part of aberrations of chromosome type were not revealed. Professional irradiation with average annual doses from 1 to 10 rads caused the increase of aneuploid cells frequency. It was shown that the distribution of the persons according to the frequency of aberrant cells, not having contact with radiation in a dose less than 5 rads annually, corresponds to Poisson distribution. (auth)

**647** INFLUENCE OF BLOOD OXYGENATION DURING IN VITRO IRRADIATION ON THE YIELD OF DICENTRIC CHROMOSOMAL ABERRATIONS IN LYMPHOCYTES. Liniecki, J.; Bajerska, A.; Karniewicz, W. (Inst. of Occupational Medicine, Lodz, Poland). Bull. Acad. Pol. Sci., Ser. Sci. Biol.; 21: No. 1, 69-76(1973).

A freshly drawn venous blood, blood oxygenated by equilibrium with expired air and whole-blood nonstimulated (PHA-) microcultures of lymphocytes (average partial oxygen tension of 30, 150, and 177 mm Hg, respectively) were irradiated with x-rays doses in the range from 50 to 450 rads, and dicentrics aberrations scored in metaphasal figures of lymphocytes cultured for 51 h. Whereas the dose-effect relationship for irradiated PHA(−) cultures and the aerated blood were not significantly different from each other, that for the venous blood was displaced significantly toward lower values of the dependent variable. When the dose response curves were fitted to equation of the type $y_d = ax^\beta$, the values of the exponent $\beta$ were significantly higher ($\beta = 1.5$) for all three series than that for PHA (+) cultures irradiated in previous studies ($\beta = 1.1$ to 1.2). Additionally, the effect of temperature during irradiation of the venous blood upon aberration yield was studied and found much less pronounced than that operating for irradiated PHA(+) cultures. On basis of available data, it is postulated that in vitro irradiation of venous blood should yield an adequate reference system for in vitro vs. in vivo dose-effect comparisons. (auth)

**648** CANCER OF THERAPEUTIC ORIGIN. Belpomme, D.; Blondel, P.; Mathe, G. (Hopital Paul-Brousse, Villejuif, France). Vie Med. Can. Fr.; 1: 140-150(Feb 1972). (In French).

A bibliographic review is given of clinical studies of cancers of therapeutic origin. Cancers induced by radiotherapy, cancers secondary to hormone therapy, cancers induced by common medications, and cancers secondary to antimitotic and immunodepressor treatments are considered in succession. (149 references). (J.S.R.)

**649** COMPLICATIONS IN SUPERVOLTAGE THERAPY OF UTERINE MALIGNANCIES. Kob, D.; Arndt, J.; Schuberth, K.; Pohl, E. (Friedrich-Schiller Univ., Jena, Ger.). Zentralbl. Gynaekol.; 94: No. 42, 1377-1387(21 Oct 1972). (In German).

Complications following supervoltage therapy are reported for 167 patients with carcinoma of the cervix and for 92 patients with carcinoma of the uterus. With respect to the urinary tract, the radiation-induced complications are much lower than those caused by the tumor, even before radiotherapy. Because of its low tolerance, the rectal mucosa shows radiation-induced complications more frequently than any other organ adjacent to the uterus. (tr-auth)

**650** ABDOMINAL RADIOGRAPHY OF WOMEN OF CHILD-BEARING AGE. Warrick, C. K. (Royal Victoria Infirmary, Newcastle-upon-Tyne, Eng.). Brit. J. Radiol.; 46: No. 548, 647 (Aug 1973).

A summary is presented of the results of an enquiry concerning the implementation of the 10 Day Rule (i.e., confining abdominal radiography to the pre-ovulatory phase of the menstrual period in women of child-bearing age). Findings are tabulated on the basis of replies from 62 hospitals in the first four months of 1973. (UK)

**651** STATE OF HARD DENTAL TISSUES, DEPENDING ON THE DOSE AND LOCALIZATION OF IRRADIATION. Borovskii, E. V.; Segen, I. T. Stomatologiya; 52: 16-18(1973). (In Russian).

Results are presented of clinical observation on the condition of hard dental tissues in 482 patients subjected to radiation therapy for neoplasms of the area of the head and neck (350) and of the pelvis (132) at periods up to 3 yrs. One hundred and six persons of two age groups (31 to 40 and 41 to 50 yrs) served as controls. Caries-pulpitis state (CPS) was determined in relation to the dose and localization of irradiation. In irradiation of the head and neck in persons aged from 41 to 50 yrs with a sum total irradiation dose of 6,000 to 10,000 R, caries increase was greater (statistically significant values, $P < 0.05$) than in the controls at periods of 12, 24, and 36 months after the radiation therapy; with the doses of 2,000 to 6,000 R at periods of 36 months. In persons aged from 31 to 40 years the difference in the CPS change was statistically significant in 24 hrs with a sum total dose of 6,000 to 10,000 R. Investigations have shown that with increase of the sum total irradiation dose CPS proved to be elevated at earlier periods. (auth)

**652** CHANGES IN PERIPHERAL BLOOD PROPERTIES DUE TO TOTAL IRRADIATION OF HUMANS. Brilliant, M. D.; Vorob'ev, A. I. Probl. Gematol. Pereliv. Krovi; 17: 27-31(Jan 1972). (In Russian).

Leucocyte and thrombocyte levels in the peripheral blood after whole-body irradiation of the human depend on the dose of radiation and may serve as a biological dosimeter. A brief literature review (6 references) indicated a marked dependence of changes in blood characteristics on the radiation dose, with leucopenia and thrombocytopenia increasing with increasing dose. Observations made on five human patients that had received radiation doses of from 50 to 200 rads indicated that the time of lowest leucocyte and thrombocyte counts depended on the size of the dose; with higher doses, the lowest values for these cells were found closer to the time of irradiation. The greatest cytopenia ranged from 100,000 for the 50-rad patient to 30,000 for the 200-rad patient. (TTT)

**653** RADIATION-INDUCED SMALL BOWEL INJURY FOLLOWING TELECOBALT THERAPY OF BLADDER TUMOR. Nummi, P.; Tiitinen, J.; Maehoenen, H. (South Saimaa Central Hospital, Lappeenranta, Finland). Scand. J. Urol. Nephrol.; 7: 30-32(1973).

Five surgically treated cases of radiation-induced injury of the small bowel, of a series of 34 patients with bladder tumor irradiated with telecobalt, are described. The onset of the symptoms was relatively acute. The radiation-induced injury of the terminal part of the small bowel can often be observed by roentgenography even before the onset of subjective symptoms. The treatment consists of resection of the injured part of the intestine. (auth)

**654** CARCINOMA OF SIGMOID COLON OCCURRING AFTER RADIATION THERAPY FOR CARCINOMA OF THE CERVIX: REPORT OF A CASE. Bhagabati, J. N.; Zaman, N. (Asam Medical Coll., Dibrugarh, India). Indian J. Med. Sci.; 27: 143-145(Feb 1973).

Cases developing bowel complications following radiation therapy for carcinoma of the cervix should be carefully followed up. Early detection of such a primary tumour in the patient would facilitate prompt institution of definitive therapy to the benefit of the patient. A rare case of primary carcinoma of the sigmoid colon occurring after irradiation therapy for carcinoma of the cervix is presented. (auth)

**655** PROBLEMS OF SHIELDING IN THE MEDICAL USE OF IONIZING RADIATIONS. Ottolenghi, G.; Percoco, V. D. (Univ., Turin). Minerva Med.; 64: 1183-1199(18 Apr 1973). (In Italian).

The most common shielding problems arising in the medical use of ionizing radiation are discussed and some solutions are suggested. Particular attention is drawn to questions connected with protection against radiation escaping through holes accidentally or deliberately made in the shields themselves. Practical solutions for the shielding of the various types of radiation used in the medical field are illustrated with respect to the type and energy of the radiating source and to the various materials commonly employed in the construction of shields. (auth)

**656** EXPERIENCE IN RADIOTHERAPY OF VULVAR CARCINOMAS. Makoski, H. B.; Sack, H. (Univ., Essen). Geburtsh. Frauenheilk.; 33: 274-271(Apr 1973). (In German).

The management of 137 patients with carcinoma of the vulva is reported. The mean age at the onset of the disease of the patient was 64.1 yrs. Between 34 and 45% of the patients had diabetes. The predominant type of carcinoma was squamous cell carcinoma with the lesion originating from the labia. Metastases were found in eight patients. The value of lymphography in the management of carcinoma of the vulva is discussed. The 5 year survival rate was 24%. In the group of patients receiving radiotherapy alone, a high incidence of recurrence was observed. Following adequate surgery for carcinoma of the vulva, the incidence of recurrence was low. It is concluded that a mature carcinoma of the vulva cannot be cured by radiotherapy as the only modality. (auth)

**657** SKIN DOSE AND VOLUME DOSE IN MACRORADIOGRAPHY OF HIGH MAGNIFICATION. Maekoshi, H. (Nagoya Univ., Japan); Fujita, T.; Sakuma, S. Nippon Igaku Hoshasen Gakkai Zasshi; 33: No. 4, 336-343(Apr 1973). (In Japanese).

The skin dose and the volume dose of a patient undergoing macroradiography of 4- and 8-fold magnifications are determined. The thermoluminescent dosimeter ($M_{g2}SiO_4$: Tb) was used to measure skin dose and dose distribution in the water phantom of 5, 10, 15, or 20 cm in thickness. The volume dose was calculated from these isodose curves. The exposure conditions of the macroradiography were 118 kV in the tube voltage and 1.5 mA in the tube current with the fixed focus film distance of 100 cm with exception of the case of normal radiography. The dose was measured for the field size of 2 cm x 2 cm under a condition of the magnification ratio of 1, 4, and 8. The skin dose as well as the volume dose showed maximum in 8-fold macroradiography in this experiment, when the distance between the focus and the film was fixed. The dose was next measured for the field size of 5 cm × 5 cm for 8-fold macroradiography, for the field size of 10 cm × 10 cm in macroradiography in 4-fold magnification, or for the field size of 30 cm × 30 cm for normal radiography.

The volume dose in the case of the field size of 5 cm × 5 cm in macroradiography of 8-fold magnification and that of 10 cm × 10 cm field size of that of 4-fold magnification provide almost the same value while the skin dose of the macroradiography in 8-fold magnification is about four times that in 4-fold magnification. (auth)

**658** DETERMINING THE COST OF RADIATION EXPOSURE TO POPULATIONS FOR PURPOSES OF COST-BENEFIT ANALYSES. Cohen, J. J. (Univ. of California, Livermore). Health Phys.; 25: No. 5, 527-528(Nov 1973).

The biological cost of radiation damage is calculated to be ≃ 200 $/man-rem. This figure is compared with previous estimates that were derived using different assumptions and found to be in good agreement. It is concluded that on present knowledge it might be reasonable to assume that safety expenditures in excess of a few hundred dollars per man-rem of exposure avoided cannot be considered cost effective. (UK)

**659** RELATIVE SURFACE DOSES FROM SUPERVOLTAGE RADIATION. Gray, L. (Yale Univ., New Haven). Radiology; 109: No. 2, 437-442(Nov 1973).

Ionization measurements were taken to determine the relative surface dose for several supervoltage modalities. The relationship of relative surface dose and the physical treatment variables was studied for a Varian 4-MeV accelerator. Comparisons were then made between 4-MeV (with 2 different flattening filters), 6-MeV, and cobalt-60 radiation. For a given therapy unit, dependent variables for skin doses are target-skin distance, field size, shadow tray-skin distance, tray construction, beam entrance angle, distance on skin from central axis, and any beam modifying devices such as wedges. Loss of skin sparing for megavoltage therapy results from electron contamination arising from unfavorable combinations of these variables. (auth)

**660** DOUBLE-CENTERED ROTATIONAL TECHNIQUE IN $^{60}$Co TELETHERAPY. Fayos, J. V.; Kanellitsas, C.; Choi, M. C. (University Hospital, Ann Arbor, MI). Radiology; 109: No. 2, 447-450(Nov 1973).

The use of a double-centered rotational technique with $^{60}$Co teletherapy allows greater flexibility in the treatment of deep-seated tumors, particularly malignant pelvic neoplasms where other forms of treatment are not satisfactory. A wide range of treatment plans can be obtained by altering the isocenter height, field size, angles of each arc, and distance between the centers of rotation. The dose is calculated by mathematical expressions introduced into a program using the University of Michigan IBM 360/67 computer. This allows the development of a treatment plan with a minimum of time and cost. (auth)

**661** RESPONSE OF A MURINE SOLID TUMOR TO IN VIVO COMBINED CHEMOTHERAPY AND IRRADIATION. Wharam, M. D.; Phillips, T. L.; Kane, L.; Utley, J. F. (Univ. of California, San Francisco). Radiology; 109: No. 2, 451-455 (Nov 1973).

The EMT6 murine solid tumor was employed to examine the combined effect of gamma irradiation and chemotherapy. A dose of cyclophosphamide, actinomycin D, BCNU, and bleomycin A2, selected to yield a 10% survival fraction when given singly, was administered 2 hrs before single graded doses of whole-body irradiation and the results compared to a radiation-only dose-response curve. Bleomycin A2 and BCNU modified the shoulder region of the curve. Actinomycin D was less than additive in the hypoxic region of the curve, while cyclophosphamide was simply additive throughout the curve, suggesting that it killed both well-oxygenated and poorly-oxygenated tumor cells in similar proportions. (auth)

**662** ENVIRONMENTAL HAZARDS. Hanlon, J. J. Fed. Proc.; 31: No. 6, 101-120(1972).

The relationship of environmental factors to human health is reviewed with emphasis on hazards resulting from technological advancements, including radiation, chemical pollutants, and noise. It is pointed out that man has always been exposed to radiation from natural sources in his environment but that the rapidly expanding use of ionizing and nonionizing radiations for diagnostic medical procedures, power development, weapons manufacture and testing, and communications has greatly increased his exposure. In the USA it is estimated that 45% of the annual radiation dose to man is from natural sources, 45% is from medical exposures, and that other sources, including fallout, luminous watch dials, and television screens account for the rest. The potential hazards from the development of the nuclear power industry, with the possibility of release of radioactive wastes from reactors, fuel reprocessing plants, and waste storage areas are considered briefly. It is emphasized that the development of radiation protection standards has led to the control of radiation hazards by the nuclear industry and in military applications of nuclear energy and that the control of hazards during medical uses of x radiation and radioisotopes for diagnosis purposes has received critical attention from the medical profession during the past few years. It is suggested that additional research is needed in the fields of the genetic effects of radiation, radiation effects on developing fetuses resulting from diagnostic exposure of the pregnant mother, and radiation problems related to tritium release to the environment. (CH)

**663** MANAGEMENT OF COMPLICATIONS IN HEAD AND NECK SURGERY. Zarem, H. A. (Univ. of Chicago). Surg. Clin. N. Amer.; 53: No. 1, 191-201(Feb 1973).

Recognition of the potential complications during or subsequent to operative procedures about the head and neck allows the surgeon to avoid these problems or to recognize them in their early stages. Most fatalities directly related to the operative management of these patients occur from airway obstruction or from exsanguinating hemorrhage. Although patients with extensive tumor and extensive irradiation induced tissue changes about the head and neck may necessarily succumb from these two complications, fatality from airway obstruction or exsanguinating hemorrhage is avoidable in the patient with early disease. Careful attention to the anatomic structures in the head and neck region allows definitive decisions as to the transection of nerves, avoidance of lymph fistulas, and proper cancer ablative procedures. Reconstructive concepts which permit removal of irradiated or infected tissues minimize the likelihood of wound breakdown. Preoperative planning of functional problems permits control and reconstruction to minimize the morbidity of postoperative dysphagia, drooling, and cosmetic deformity. Any surgeon undertaking operative procedures about the head and neck must be thoroughly familiar with all of the potential complications and the concepts which will allow him to avoid and manage these problems with a degree of sophistication in keeping with the current status of modern surgery. (auth)

**664** INDUSTRIAL MEDICINE AND THE ENVIRONMENT. C. O. Sappington Memorial Lecture. Dunham, C. L. (National Research Council, Washington, DC). J. Occup. Med.; 15: No. 7, 559-563(Jul 1973).

Developments in industrial medicine in the USA are reviewed, with emphasis on the relation of industrial medicine to radiation protection programs for personnel. The expansion of the field of occupational medicine to include all aspects of environmental protection for both personnel and the general population against environmental pollutants, such as lead, carbon monoxide, nitrous oxide, sulfides, asbestos, and a host of polycyclic hydrocarbons, as well as for protection against radioactivity released to the environment is discussed. (CH)

**665** NEW DATA ON THE USE OF DIMETHYL SULFOXIDE IN EXPERIMENTAL AND CLINICAL DERMATOLOGY. Survey of the Literature. Datskovskii, B. M.; Zaks, A. S.; Mitryukovskii, L. S. Vestn. Dermatol. Venerol.; 47: 30-36(Jan 1973). (In Russian).

A review of 241 reports published in recent years dealing with various aspects of the effect of dimethylsulphoxide (DMSO) on the skin is presented. Properties of DMSO such as penetrability, transporting capacity, and radioprotective effect are discussed as well as the prospects of the use of the drug in experimental oncology and allergology (in dermatological aspect). Materials on the effect of DMSO on the skin and the results of its use in clinical practice for treatment of sclerodermia, psoriasis, eczema, mycoses, and other diseases are presented. (auth)

**666** USE OF C-G (HYTHIOL CAPSULE) IN PATIENTS TREATED WITH IRRADIATION. Otake, H.; Suzuki, T.; Oikawa, M.; Hoshino, T. (Iwate Medical Coll., Morioka, Japan). Shinryo To Shinyaku; 10: No. 3, 547-550(Mar 1973). (In Japanese).

The C-G capsule (C-G), which contains 89 mg of L-cysteine and 120 mg of glucose in one capsule, was administered to the patients treated with irradiation, and protective effects of C-G on radiation injury were studied from the change of the leukocyte number before and a week after irradiation. Cases treated with irradiation were 25 cases including 10 cases of cervical uterus tumor. Radiation sources used in therapy were telecobalt, 10 MeV x-ray of linac, and 8 MeV electron beam. A dose of 4000 to 18,000 rads was delivered. In ten cases of cervical uterus tumor, 6690 to 7350 rads air dose was delivered to the lower extremities at opposing two fields. Six C-G capsules were administered daily from the beginning of irradiation until a week afterwards. Six cases except cervical uterus tumor showed change of the leukocyte number within ±10%, four cases of cervical uterus tumor and four cases except cervical uterus tumor showed a 10 to 20% decrease of the leukocyte number, and five cases of cervical uterus tumor and five cases except cervical uterus tumor showed a 20 to 50% decrease. A case of cervical uterus tumor showed a 30 to 40% increase. An actual leukocyte number in 1 mm$^3$ was decreased from 4840 to 4390 in ten cases of cervical uterus tumor (24% reduction) and it was decreased from 6727 to 5520 in cases except cervical uterus tumor (18% reduction). Concerning reduction of the leukocyte number, C-G was suspected to act protectively. (JA)

**667** PREVENTIVE MEDICINE IN NUCLEAR EMERGENCIES AND THE ROLE OF THE PHYSICIAN IN NATIONAL DEFENSE. Pejuskovic, B. (Government Secretary for Health and Social Welfare, Belgrade). Narodno Zdravlje; 27: No. 3, 100-102 (Mar 1971). (In Serbo-Croatian).

The likelihood of nuclear, chemical, and biological weapons being used in war necessitates the peacetime training of the general practitioner in recognizing the symptoms of injuries caused by such weapons. He must also be able to treat the victims, institute prophylactic measures before an attack, and understand the effect of these weapons on the environment, particularly the food and water supply. Further, he should be able to protect the patients under his care from subsequent injury. (TTT)

**668** DNA REPAIR WITH PURINES AND PYRIMIDINES IN RADIATION- AND CARCINOGEN-DAMAGED NORMAL AND XERODERMA PIGMENTOSUM HUMAN CELLS. Cleaver, J. E. (Univ. of California, San Francisco). Cancer Res.; 33: 362-369 (Feb 1973). (UCSF-10P2-169).

Repair replication of DNA in cells exposed to uv, x rays, or chemical carcinogens involves incorporation of both purine and pyrimidine precursors. Previous reports stating that purines are not involved in repair must be due to insufficient resolution in the reported experiments. Hypoxanthine was more efficiently incorporated by repair replication than other precursors such as adenine, deoxyadenosine, and guanine. Hydroxyurea did not inhibit hypoxanthine incorporation by repair replication. Cells from patients with the hereditary high-cancer disease xeroderma pigmentosum show reduced repair after exposure to uv, 4-nitroquinoline 1-oxide, and 1,3-bis(2-chloroethyl)-1-nitrosourea; they show normal repair after exposure to agents such as N-methyl-N′-nitro-N-nitrosoguanidine. These results allow agents to be classified according to whether or not xeroderma pigmentosum cells respond normally to them and illustrate the values and limitations of the use of xeroderma pigmentosum cells or measurements of DNA repair as test systems for carcinogens. (auth)

**669** ENHANCEMENT OF RADIATION EFFECTS BY CHEMOTHERAPY. Vermund, H. (Univ. of California, Irvine). Acta Radiol., Suppl.; No. 311, 1-78(1971).

This review covers the basic rationale for and the clinical experience with the use of chemicals for enhancement of ionizing radiation effects on malignant tissues. Chemical sensitization of cells to ionizing radiation was demonstrated in cell cultures and in experimental animal systems. It remains to be determined how best to utilize this sensitization for the benefit of patients with malignant tumors. (SW)

**670** EXPERTISE ON GLAUCOMA PATIENTS. Leydhecker, W. (Univ. Augenklinik, Wuerzburg, Ger.). Klin. Monatsbl. Augenheilk.; 162: 262-268(Feb 1973). (In German).

The difficulties encountered in cases of glaucoma where external factors are brought into relationship with the disease are discussed. The discussion is based on the author's own case collection. Glaucoma simplex seldom requires compensation e.g., when medical treatment had been impossible over several years. Acute angle glaucoma requires compensation when its occurrence can be brought into connection with an exceptionally emotional environmental situation. In chronic angle closure glaucoma an aggravation of the situation brings about an acute increase of I. O. P. or when treatment has been impossible. A glaucoma can occur decades after tears of the ciliary body after contusions. The diagnosis can be established only through comparative gonioscopy of the two eyes. Even complicated cases can be clarified through exact reconstruction of the course of disease and the findings supported by consultations with the ophthalmologists who treated the cases before. Examples of such cases are shown. Consensual changes of I. O. P. occurred only in 0.5% of cases. The question of conditions under which the assumption of a consenual glaucoma can be apparently assumed is discussed. A case of secondary pigmentary glaucoma through x rays is presented. (auth)

**671** PREVENTABLE COMPLICATIONS OF PTERYGIUM EXCISION WITH BETA IRRADIATION. Cameron, M. E. Brit. J. Ophthalmol.; 56: No. 1, 52-55(Jan 1972).

It is reported that during 15 years of experience covering many thousands of cases of pterygium excision with $\beta$ irradiation no serious complications arose until recently. Five cases of serious complications are considered. Two exhibited very irritable eyes, two extremely indolent ulcers, and in the fifth case the ulcer perforated and the eye was lost. These cases were investigated and it was concluded that the grim results in three were due to faulty surgical technique (mainly too many applications by a large-tipped cautery), in another to impaired blood supply to the anterior segment, and in the last too much $\beta$ irradiation. (UK)

**672** SPECIFIC CHARACTERISTICS OF THE CLINICAL COURSE AND TREATMENT OF WOUNDS IN THE MAXILLOFACIAL REGION UNDER CONDITIONS OF ACUTE RADIATION SICKNESS. Kavrakirov, V.; Georgiev, N. Voenno Med. Delo; 28: No. 2, 9-13(1973).

Experience with pure traumatic injuries in the maxillofacial region acquired in work at the Higher Military Medical Institute and published data on combined radiation-traumatic injuries obtained in animal experiments are discussed. The increased susceptibility to local infection and inflammation in radiation sickness is pointed out. Surgical dressing of wounds in the region in question in cases of radiation sickness should be carried out in such a manner that a minimum trauma is inflicted and should be especially thorough, according to the authors. In the treatment of bone wounds, careful disinfection and complete closing of the wounds from the side of the oral cavity are essential. In the immobilization of bone fractures, intermaxillary fixation should be carried out during the latent period of radiation sickness. Methods of fixation should be applied that do not damage the mucosa, gingival margin, and periosteum and do not interfere with the maintenance of mouth hygiene or feeding of the patient. (JPRS)

**673** IRRADIATION PLANNING FOR THE LUMBAL LYMPH NODES BY USE OF THE LYMPHOGRAM. Rosenow, U.; Doench, K.; Mueller, H.; Mueller-Heine, F.; Frischkorn, R. (Univ., Goettingen, Ger.). Strahlentherapie; 145: No. 5, 549-555(1973). (In German).

The particular difficulty of the irradiation planning for lumbal lymph nodes is due to the neighborhood of sensitive organs, such as spinal cord, intestine, and especially the kidneys. Therefore, for $^{60}$Co gamma radiation, various fixed-field and pendulum irradiations were computed by a program for electronic calculation of dose distributions; by varying all the parameters in question, it was tried to obtain optimal values. The examinations were performed on an anatomic standard cross section and led to two irradiation techniques of nearly equal value. In the individual case, selection of the appropriate irradiation plan requires the localization of the lymph nodes and, if possible, of the kidneys; this is done by radio-stereoscopic pictures after contrast radiography. (GE)

**674** RADIATION DOSE TO THE OVARY DURING ROUTINE HYSTEROSALPINGOGRAPHY, RADIOGRAPNY, TELEVISED FLUOROSCOPY, PHOTOFLUROGRAPHY, AND CINERADIOGRAPHY. De Vecchi, A.; Fava, G.; Sichirollo, A. E.; Zonca, G. C.; Verrengia, F. Ann. Radiol. Diagn.; 44: No. 3, 247-262 (1972). (In Italian).

A series of measurements of radiation doses received by the gonads of women undergoing hysterosalpingograpny was carried out using solid-state (LiF in powder form) dosimeters in an anatomical Rando phantom; the methods of investigation considered were those in common clinical use: fluoroscopy, radiography, TV-fluoroscopy, photofluorography, and cineradiography. The results obtained showed that, in consideration of the radiation doses received by the patients, TV-fluoroscopy is preferrable to routine fluoroscopy and that photofluorography gives informations as valuable as those obtained from multiple radiography; cineradiography, which entails very high doses to the patients, should be strictly limited to exceptional cases. (INIS)

**675** RADIATION PROTECTION MANUAL. Rome; Comitato Nazionale per l'Energia Nucleare (1972). 144p. (In Italian).

The manual is intended to be a source of basic information on the nature, the dangers of, and the precautions against radioactivity for all people whose work is connected with some radiological risk. (INIS)

**676** URETERORECTAL FISTULA. Case Report and Review of the Literature. Doremieux, J.; Masson, J. C.; Thomas, M.; Bollack, C. (Service de Chirurgie Urologique, Strasbourg). Acta Urol. Belg.; 40: No. 3, 631-644(Jul 1972). (In French).

An exceptional case of right uretero-rectal fistula is reported that appeared twelve months after an intracavitary irradiation therapy. Recovery was obtained after nephrectomy; however, a review of the nine other published cases suggests the possibility of saving the kidney by vesical reimplantation. Most cases appear as ureteral complications of gynecologic surgery. (auth)

**677** RADIATION SENSITIVITY OF TISSUES IRRADIATED DURING MANTLE TREATMENT OF HODGKINS DISEASE. Landberg, T.; Baldetorp, L.; Lindberg, L. G.; Svahn-Tapper, G. (Lunds Universitetssjukhus, Sweden). Acta Radiol., Ther., Phys., Biol.; 11: No. 6, 521-535(Dec 1972).

Clinical observations and post mortem findings in various tissues irradiated during mantle treatment with the split-course technique in two cases of Hodgkin's disease are reported. The radiation sensitivity of the lungs, heart and pericardium, nervous system, and bone marrow is discussed. It is suggested that the irradiation may with advantage be extended over a relatively large number of fractions and a long period of time in order to minimize the risk of radiation reactions of healthy tissue. (auth)

**678** BIOLOGICAL EFFECTS OF IONIZING RADIATIONS. Goyffon, M. (Museum National d'Histoire Naturelle, Paris). Rev. Quest. Sci.; 144: No. 3, 337-372(1973). (In French).

If it is recognized that biological lesions arise from molecular lesions, it should be possible to study biological phenomena through the use of experimental models. However, this method can not be used for interpreting differences in radiosensitivity in the different groups of organisms; the law of Bergonie and Tribondeau states that chemical radioprotection or repair of radiolesions in nucleic acids gives only a partial response. The study of chemical radioprotection shows that, although a certain number of explanatory mechanisms can be demonstrated in vivo, they have not been confirmed in vitro. In spite of the effectiveness of ionizing radiations for the living cell, their use in all fields of industrial, scientific, and medical technology does not cease to grow, which is all the more reason for studying and understanding the effects. (tr-auth)

**679** DEVELOPMENT OF A UTERINE SARCOMA 18 YEARS AFTER RADIOTHERAPY FOR CARCINOMA OF THE UTERINE CERVIX. Rauskolb, H. E. R. (Univ. Giessen, Ger.). Geburtsh. Frauenheilk.; 32: 1034-1037(1972). (In German).

The case history describes a patient who developed a uterine sarcoma 18 years after radiotherapy for carcinoma of the uterine cervix. Two similar cases are reported in the world literature and are discussed. It is concluded that the second tumor had no causal connection with the radiation treatment. Various possibilities of its origin are discussed. Perhaps a second-look curettage would have permitted earlier detection of the malignancy. (HBG)

**680** EFFECTS OF IONIZING RADIATION IN THE FETAL PERIOD. Tampalini, L. (Divisione Medicina Ospedale dei Bambini, Brescia, Italy). Minerva Pediat.; 24: 2004-2007(17 Nov 1972). (In Italian).

The data on the effects of radiation during the fetal period are summarized with emphasis on the most dangerous period of the first three months and particularly from the 3rd to the 9th or 10th week and on later effects on the nervous system and the gonads. (32 references) (JSR)

**681** OCCUPATIONAL FACTORS IN THE EPIDEMIOLOGY OF LEUKEMIA IN HIROSHIMA AND NAGASAKI. Ishimaru, T. (Japanese National Inst. of Health, Hiroshima); Okada, H.; Tomiyasu, T.; Tsuchimoto, T.; Hoshino, T.; Ichimaru, M. Amer. J. Pub. Health; 93: No. 3, 157-165(1971).

A total of 492 patients with leukemia with onset during 1945 to 1967 in Hiroshima or Nagasaki was selected from the ABCC Leukemia Registry, and an equal number of controls was selected. During 1966 to 1969 the patients and controls were interviewed. In 303 pairs of patients and controls the risk was 2.5 times higher among those with a history of probable occupational exposure to benzene and medical x rays. The change in relative risk of leukemia due to a combination of the two factors was also examined. (HLW)

**682** XERODERMA PIGMENTOSUM: PROGRESS AND REGRESS. Cleaver, J. E. (Univ. of California, San Francisco). J. Invest. Dermatol.; 60: No. 6, 374-380(1973). (UCSF-10P2-143).

Xeroderma pigmentosum is an autosomal recessive human skin disease whose outstanding clinical symptom is an increased frequency of actinic carcinogenesis. The most common form of XP has a reduced capacity for excision repair of uv damage to DNA; the site of the defect is at the initial stage of the repair pathway. These XP cells are precisely analogous to bacterial strains UVR$^-$, HCR$^-$. Two minor variants of the disease with similar skin symptoms are known. One has a similar but complementary defect in excision repair and additional severe neurological symptoms. The other apparently has normal excision repair and normal uv sensitivity in vitro. From considerations of resolution and our experience in one test case, prenatal diagnosis of XP is practicable, and autoradiography (to measure unscheduled synthesis) is the most reliable and sensitive method to use although several other methods are also applicable. Carcinogenesis in XP may develop through the unrepaired damage in DNA which leads to genetic changes (mutations, chromosome aberrations) or viral transformation. (auth)

**683** RADIATION-INDUCED BREAST CANCER. Warren, S. (New England Deaconess Hospital, Boston). Contract AT(11-1)-3017. Cancer; 32: No. 4, 991-993(Oct 1973).

A case of radiation-induced breast cancer is reported in a woman who had been fluoroscoped repeatedly for control of therapeutically induced pneumothorax over 40 years before. The more superficial breast tissue probably received about 2400 R. Data on prevalence of breast cancer in various population groups support the conclusion that human mammary tissue appears to be only slightly susceptible to radiation carcinogenesis. (auth)

**684** VALUE OF THYROID SCINTIGRAMS CARRIED OUT AFTER A THERAPEUTIC DOSE OF RADIOACTIVE IODINE $^{131}$I. Rusiecka, E.; Gasiorowski, W.; Wojciechowski, J. Pol. Tyg. Lek.; 27: 1259-1261(1972). (In Polish).

Scintigrams of the thyroid were carried out in patients with hyperthyroidism treated with $^{131}$I. Scintigrams were done after administration of a therapeutic dose of this isotope. The procedure was done in 20 cases including twelve cases of Graves' disease and eight cases of toxic nodular goiter. Scintigrams were performed 5, 10, 20, 30, and 60 days after administration of a therapeutic dose of isotope. In cases with a significant reduction in the size of thyroid occurring 3 to 4 weeks after a therapeutic dose of $^{131}$I the therapeutic result was very good, while in cases without any change in the size of the gland after treatment hyperthyroidism recurred and another dose of radioactive iodine had to be given. A good effect of $^{131}$I treatment was obtained also in cases of autonomous hot thyroid nodules in which appearance of paranodular thyroid tissue was obtained 4 weeks after administration of radioisotope. The cases without visualization of perinodular parenchyma required repeated administration of $^{131}$I. It is suggested that periodical scintigraphic examinations after therapeutic doses of $^{131}$I using the radioactivity may have a prognostic value in evaluation of the results of treatment of hyperthyroidism with radioactive iodine. (auth)

**685** PROTECTION OF WORKERS AGAINST IONIZING RADIATIONS IN BELGIUM. Hublet, P. (Ministere de l'Emploi et du Travail, Brussels). J. Belge Radiol.; 56: No. 2, 184-189 (1973). (In French).

The drawing up of Belgian regulations is based on the basic standards of the European Atomic Energy Community (EURATOM) relative to the health protection of the population and of workers against the dangers resulting from ionizing radiations. These norms were made the object of the directives of the Council of the European Atomic Energy Community dated 2 February 1959, 5 March 1962, and 27 October 1966. The law on the basis of which the stoppages in execution rested is that of 28 March 1958 relative to the protection of the population against the dangers resulting from ionizing radiations. The stoppages of execution are those of 28 February 1963, 15 March 1963, 17 May 1966, 22 May 1967, and 23 September 1970. The radioactive sources or the apparatuses emitting ionizing radiations are the object of a procedure of authorization and ought to be controlled by the organizations agreeing to some minimum time intervals. (tr-auth)

**686** RARE COMPLICATION RESULTING FROM RADIOTHERAPY OF SPINAL CORD MALIGNANCY. Ozarda, A. T.; Henzel, J. (Univ. of Missouri, Columbia). Radiat. Eff.; 19: No. 2, 123-125(Jun 1973).

A rare complication of irradiation is reported of a ten-year-old boy who was treated by supervoltage irradiation following decompressive laminectomy for his primary spinal cord neoplasm. He probably received average dose of (4500) rads to a limited segment of his duodenum, within the six weeks. He developed this complication nine months after the completion of treatment. The dose-time-volume factors are considered sufficient enough to produce such complications; however, there were apparent contributory factors such as unusual duodenal fixation and duodeno-jejunal ligament foreshortening. (auth)

**687** PARENTAL X IRRADIATION AND CHROMOSOME CONSTITUTION IN THEIR SPONTANEOUSLY ABORTED FETUSES. Alberman, E.; Polani, P. E.; Roberts, J. A. F.; Spicer, C. C.; Elliott, M.; Armstrong, E.; Dhadial, R. K. (Guy's Hospital Medical School, London). Ann. Hum. Genet.; 36: No. 2, 185-194(Nov 1972).

The total dose of x irradiation received before conception by 845 mothers having spontaneous abortions was compared with that received by mothers of livebirths matched for age and time of conception. The mothers of the abortions had had more radiation than their controls. This was true particularly of the mothers of fetuses of abnormal chromosome constitution, that comprise about a quarter of all known constitution. The mothers of these had had significantly more radiation than those of abortions of normal chromosome constitution and significantly more than the controls. It is concluded that maternal irradiation before and during the reproductive period increases the risk of future conceptions of abnormal chromosome constitution, but it should be stressed that most of these are not viable and are lost early in pregnancy. (auth)

**688** PERSONAL PROTECTIVE DEVICES FOR WORKING WITH RADIOACTIVE SUBSTANCES. Second Edition. Gorodinskii, S. M. pp 295 of Sredstva individual'noy zashchity dlya rabot s radioaktinymi veshchestvami. Moscow; Atomizdat (1973). (In Russian).

The basic theoretical and practical questions that relate to protective devices for people working with radioactive substances are examined. Basic designs of devices for the protection of the respiratory organs and the skin are described under various conditions in working with radioactive materials. Many years of experience in research and design work in the area of protective devices is summarized. Much attention is devoted to the methods of the physiological-hygienic appraisal and verification of the protective effectiveness, correct operation, and decontamination of personal protective devices. (JPRS)

**689** IRRADIATION, METHOTREXATE TOXICITY, AND THE TREATMENT OF MENINGEAL LEUKAEMIA. Duttera, M. J.; Bleyer, W. A.; Pomeroy, T. C.; Leventhal, C. M.; Leventhal, B. G. (National Cancer Inst., Bethesda, MD). Lancet; 2: No. 7831, 703-707(29 Sep 1973).

Thirty one patients with meningeal leukemia were randomized to therapy with intrathecal methotrexate with and without 2400 R to the cranial valut. Remissions were achieved in 29 patients. Remission duration was significantly longer (234+ days) in the group receiving methotrexate alone than in those receiving methotrexate and irradiation (125 days). A spectrum of methotrexate toxicity was seen after intrathecal administration ranging in severity from chemical arachnoiditis which was common (17 patients) through transient paresis (1 patient) to encephalopathy (2 patients). These toxicities were just as common in patients receiving preservative-free methotrexate as in those receiving methotrexate with preservative. (auth)

**690** INTERACTIVE PROGRAM FOR STANDARDIZATION OF PRESCRIPTIONS IN RADIATION THERAPY. Cohen, L. (Univ. of the Witwatersrand, Johannesburg). Comput. Programs Biomed.; 3: 27-35(Mar 1973).

The cellular surviving fraction is used as a biological measure of radiation effects to evaluate and compare results of variously fractionated treatment schemes. It is derived from a kinetic model simulating the changing cell population in irradiated tissues and tumors. Equivalent single doses and response rates (probits) can also be computed on this basis. From these factors, the probability of obtaining a given "response" (cure of a tumor or a specified reaction in normal tissue) can be estimated. An interactive program (RADLOG) was developed for computing the cellular surviving fraction, equivalent single dose, probit and probability of response, from clinical dose-time-volume data. The effects of additional or alternative procedures can be explored. Also, the computer can be instructed to find the dose required to achieve a particular biological effect, specified in terms of a given degree of cellular depletion (log-surviving-fraction) or a preselected response rate. Various options can be used to take decisions on the efficiency and safety of proposed treatment schedules and to make corrective adjustments when necessary. (auth)

**691** FALLOUT FROM BOMB TESTS. Denborough, M. (Royal Melbourne Hospital, Parkville, Australia). Brit. Med. J.; 4: No. 5883, 46(6 Oct 1973).

Brief comment is made on a previous article criticizing the French bomb tests at Mururoa. (Br. Med. J. v. 4, p. 510, 8 Sep. 1973). It is pointed out that radiation doses to the thyroid gland in Australian children resulting from $^{131}$I in the milk supply after French tests, have been as high as $^{128}$millirads in a single year, and that, due to prevailing winds, fallout over the eastern Pacific and South America is much higher than in Australia. Assuming a linear relationship with the dose received and using maximum published figures for radiation risks, a group from the Australian Academy of Science has calculated that as a result of past French atomic tests, 26 cases of thyroid cancer and 14 cases of leukemia, and other cancer could occur in Australia alone. (UK)

**692** EFFECT OF 50-MeV PROTON IRRADIATION ON THE AMOUNT OF CHROMOSOMAL ABERRATION IN HUMAN PERIPHERAL BLOOD LYMPHOCYTES. Todorov, S. V.; Mileva, M.; Ivanov, B.; Bulanova, M. Eksp. Med. Morfol.; 11: 220-226(1972). (In Russian).

After irradiation of lymphocytes from human peripheral blood with doses of 25, 50, 100, 250, and 500 rads of 50-MeV protons, quantitative data were obtained on various types of chromosome disturbances such as chromosome fragments, intersticial dicentrations, rings, cells with structural aberrations, total number of aberrations, and total number of ruptures. The statistical preparation of the experimental data by the method of the smallest quadrates gave curves of regression for various chromosome disturbances, described better by the mathematical models – $y = bD^n$ and $y = a - vD$. Comparative analysis of data on the amount of chromosome aberrations after irradiation with protons of 50 MeV and roentgen rays of 180 kY showed coefficients for RBE of 1.01 for cells with structural aberrations and 1.17 for chromosome fragments. (auth)

**693** PARENTAL EXPOSURE TO X-IRRADIATION AND DOWN'S SYNDROME. Alberman, E.; Polani, P. E.; Roberts, J. A. F.; Spicer, C. C.; Elliott, M.; Armstrong, E. (Guy's Hospital Medical School, London). Ann. Hum. Genet.; 36: No. 2, 195-208 (Nov 1972).

The total dose of medical x irradiation ever received by 465 parents of children with Down's syndrome was compared with the corresponding dose for 465 parents of children with other severe congenital handicaps, matched for time of birth and maternal age. The mothers of those with Down's syndrome had had more total x rays, both in number and dose, before the conception, although overall the difference did not reach a significant level. However, mothers of the cases had received significantly more x rays ten years or more before the conception of the cases. No significant difference was found between the histories of the fathers of the cases and the controls. The practical and theoretical implications of the findings are discussed. (auth)

**694** INCREASE OF DOSE IN PRIMARY IRRADIATION OF BREAST CARCINOMA. Gaertner, E. (Staedtische Krankenhauses, Hildesheim, Ger.). Roentgen Bl.; 26: No. 2, 73-79(Feb 1973). (In German).

During 1966 to 1970 235 patients were given a total dose of at least 5000 R by means of a telecobalt apparatus. During this time 7 (3%) of the cases developed skin metastases in the areas of radiation. In a group of 150 patients, who had received a conventional, lower dose, 13% of local recurrences were observed. For cases of inoperable carcinoma of the breast with unfavorable prognosis, for patients who had not undergone radical operation, and for patients who had metastases in three or more axillary lymph nodes, the dose was increased in a second series from 5000 to 8000 to 9000 R. Individual observations gave the impression that the radiation of the second series ought to be given to large fields with inclusion of the scar, to prevent recurrences in the thoracic wall. Sclerosing, lymphatic edema, and lesions of the brachial plexus are probably somewhat more common at this large dose. (auth)

**695** STANDARDIZATION OF ROENTGEN DIAGNOSIS. I. Aims and Consequences of Standardization Guidelines. Richter, K.; Boeck, G.; Schmidt, G. Z. Aerztl. Fortbild.; 67: No. 2, 79-82(15 Jan 1973). (In German).

In the GDR, the Society of Medical Radiology formed a study group for clinical x-ray diagnosis that suggested certain standards that should be followed in the examination of stomach, thorax, urinary system, colon, and biliary system. The standards were based on the technical aspects of examinations as well as on clinical procedures, indications, and economics. Suggestions of the study group were published in several separate reports. (HBG)

**696** BIOLOGICAL ACTION OF EXTERNAL AND INTERNAL SOURCES OF RADIATION. A Collection of Articles. Moskalev, Yu. I.; Kalistratova, V. S. (eds.). Rentgenol. Radiol.; 12: No. 2, 134-135(1973). (In Russian).

Information is reviewed on the biological effects of ionizing radiation and on radiation injuries due to the combined action of external irradiation and of incorporated radioisotopes. New data on the action of fission neutrons and of neutrons mixed with other types of radiation are presented. Information on the metabolism of iodine-131, tritium, cesium-137, strontium-90, neptunium-237, plutonium-239, and americium-241 is given. Among data pertaining to the distribution of incorporated radionuclides in the organism, those dealing with the metabolism of transuranium elements and of rare earth radioisotopes deserve particular attention. Mathematical methods for the study of the metabolism of radionuclides are discussed. Although considerable attention was paid to the transuranium elements because of their practical importance and their toxicity, the information that is available at present on the biological effects of these elements is inadequate. The book gives experimental data on functional changes in the respiratory, cardiovascular, and other systems and on morphological changes in organs produced by some transuranium elements. It is brought out that under certain conditions the combined action of external gamma-irradiation from $^{60}$Co and of incorporated radioactive iodine may result in mutual weakening of the harmful effects exerted by the two factors rather than in their summation. (JPRS)

## Vertebrates

*Refer also to abstracts 518 and 628.*

**697** (COO-3017-9) VARIATIONS IN $LD_{50/30}$ IN A STRAIN OF RATS OVER 20 YEARS. Udupa, K. B.; Warren, S.; Chute, R. N. (New England Deaconess Hospital, Boston, Mass. (USA). Cancer Research Inst.). [nd]. Contract AT(11-1)-3017. 13p. (CONF-730603-12). Dep. NTIS $3.00.

From eighteenth Health Physics Society meeting; Miami Beach, Florida, USA (17 Jun 1973).

The $LD_{50/30}$ has been determined periodically for NEDH rats, male and female, from 1953 to 1973, exposed to x radiation doses ranging from 710 to 905 R. The mean was 801 R. There was no significant seasonal variation. The general health of the colony was an important factor. The advent of infection reduced somewhat the $LD_{50/30}$, while long-term exposure of the colony to infection increased this dose level slightly and gave some protection against hematopoietic damage. (auth)

**698** (COO-3378-8) IRON METABOLISM IN THE X-IRRADIATED ANIMAL. Final Report, May 1, 1968—September 30, 1972. Mazur, A. (New York Blood Center, N. Y. (USA)). 1972. Contract AT(11-1)-3378. 13p. Dep. NTIS $3.00.

The findings during the period of this research may be summarized as follows: Determination of changes in activity, per gm of tissue, of the enzyme ferrochelatase is an accurate index of changes in erythropoietic activity of bone marrow and spleen in the rat. Changes in ferrochelatase activity in tissues of the spleen-shielded x-irradiated rat demonstrate the almost complete cessation of erythropoietic activity of bone marrow and spleen, the marked stimulation of spleen activity, which reaches values twice that in the normal rat, prior to falling to normal levels, and the gradual increase in bone marrow activity to normal preirradiation levels. Proof was obtained for the biosynthesis of plasma transferrin on polysomes attached to the endoplasmic reticulum in the hepatic cell of the liver (the rough E.R.). The experimental data also demonstrate that the nascent protein then passes on into the smooth E.R. (vesicles which are free of polysomes) prior to secretion into the plasma. This mechanism helps to explain the finding that newly synthesized transferrin does not bind intracellular iron. The circulating red cell of the normal rat contains 6 multiple hemoglobins that have been separated by the method of isoelectric focusing gel electrophoresis. The relative distribution of these hemoglobins in bone marrow and spleen are the same, but differ from that seen in the adult red cell. Proof was obtained which shows that these hemoglobins are not synthesized uniformly in marrow erythroid cells at all stages of maturation, i.e., hemoglobin V is associated mostly with the youngest erythroid cell whereas hemoglobins III and IV are associated mostly with the oldest cells. (auth)

**699** (INR-1463) INFLUENCE OF HEPARIN ON THE ACUTE RESPONSE OF RABBITS EXPOSED TO SUPRALETHAL DOSES OF X-RAYS. Preliminary Information. Wegrzynowicz, Z.; Wronowski, T.; Latallo, Z. S.; Kopec, M. (Institute of Nuclear Research, Warsaw (Poland)). 1973. 13p. (In Polish). Dep. NTIS (U.S. Sales Only) $3.00.

Results of studies on the effect of whole-body x irradiation of rabbits with a single dose of 900 R on the blood clotting system and hemostasis are presented. The effect of previous treatment with heparin on the acute response (sudden death) after irradiation of rabbits with a dose of 1500 R or higher was also studied. (auth)

**700** HEAD MALFORMATION INDUCED BY X RAYS AND 5-FLUORINE-2′-DEOXYCYTIDINE (FCdR) IN MICE INBREEDING STRAIN C57BL/6Ffm. Comparative Investigation Under the Consideration of Dose-Response Relationships. Emmerich, W. Frankfurt am Main; Univ. Frankfurt am Main (1971). 52p. (In German).

Thesis.

On the mouse inbreeding strain, malformations of the skeleton of the head of fetuses were investigated with x rays and FCdR. The frequency and mark of various malformations depend on the amount of the dose given, the induction time, the type of the teratogenic agent, and the genotype of the strain. Basically however, the various malformations could neither be definitely determined between the x-ray irradiation series nor between the x-ray and FCdR test series. At the same absorption rates, the teratogenic effect in the FCdR test series was smaller than in the x-ray series. Contrary to the x-ray series, a doubling of the dose in the FCdR test series often showed no increase in the frequency of disorders. Serious malformations (cranioschisis and otocephy in the narrower sense) could be observed even with the smallest doses investigated. (GE)

**701** PARAMETERS OF THE VASCULAR SYSTEM RELATING TO RADIATION RESPONSE. Fourth L. H. Gray Memorial Conference, London, England, April 12–14, 1972. London; Medical College of St. Bartholomew's Hospital (1972). 68p. (CONF-720481-).

Separate abstracts were prepared for two papers presented at the conference. Abstracts of an additional sixteen papers presented on various aspects of the vascular system are included in the publication. (HLW)

*For abstracts of individual papers see: 702 and 703.*

**702** REVIEW OF FACTORS THAT INFLUENCE THE RESPONSE OF ENDOTHELIAL AND PARENCHYMAL CELLS TO RADIATION. Tannock, I. F. (Univ. of Pennsylvania, Philadelphia). pp 13-28 of Parameters of the Vascular System Relating to Radiation Response. London; Medical College of St. Bartholomew's Hospital (1972).

From conference on parameters of the vascular system relating to radiation response; London, UK (12 Apr 1972). See CONF-720481-.

Effects of radiation on cells of the vascular system are reviewed. Some topics discussed are: repair of mammalian cells damaged by radiation; criteria of cell death; balance of cell production and cell loss in adult tissues; intrinsic radiosensitivity of cells; techniques for assaying radiation response of endothelial cells; late effects of radiation on endothelium and parenchyma; thymidine labeling index for endothelial cells; and effects of radiation and other stresses on proliferation of endothelial cells. (HLW)

**703** IN WHAT WAYS MAY RADIATION CAUSE BLOOD VESSEL DAMAGE. Reinhold, H. S. (Radiological Inst. TNO, Rijswijk, Netherlands). pp 29-38 of Parameters of the Vascular System Relating to Radiation Response. London; Medical College of St. Bartholomew's Hospital (1972).

From conference on parameters of the vascular system relating to radiation response; London, UK (12 Apr 1972). See CONF-720481-.

A review is presented of radiation damage to blood vessels with regard to the following factors: radiation injuries to the constituents of the blood vessel wall, the tunica adventitia, tunica media, and tunica intima; functional disorders resulting from damage to the endothelial lining; relative significance of radiation damage to endothelial cells and other cells such as smooth muscle cells; relation of radiation dose to endothelial cell survival; denudation of blood vessels due to radiation damaged endothelial cells; effects of radiation on blood flow in the lungs, brain, liver, and skin; and radioinduced changes in capillary permeability. (HLW)

**704** CHANGE IN SKIN TEMPERATURE UNDER THE EFFECT OF IONIZING RADIATION. Taratukhin, V. R.; Rappoport, I. A.; Lemesh, G. A. Med. Radiol.; 18: No. 8, 61-63(Aug 1973). (In Russian).

X-irradiation of white rats produces changes in the skin temperature that begins at doses of 50 and 100 R. After exposure to the $\beta$ irradiation of $^{85}$Kr at a dose of 7.4 krad a persistent statistical authenic increase of the skin temperature was observed with a tendency to normalization on the 28th day. (tr-auth)

**705** GLYCOLIPID CONTENT OF BRAIN OF RATS AFTER ADMINISTRATION OF AMINAZINE AND ACTION OF IONIZING RADIATION. Norman, T. N. (Belorussian State Univ., Minsk). Vestsi Akad. Navuk BSSR, Ser. Biyal. Navuk; No. 4, 99-101(1973). (In Belorussian).

X-ray doses of 700 R caused changes in the gangliosides and cerebrosides of the brains of intact and adrenalectomized rats. When the central adrenoreactive structures of the reticular formation were blocked with aminazine, the ganglioside levels dropped in the brains of the irradiated animals. The results support the premise that the harmful action of ionizing radiation is through the receptor structures of the hypothalamus-pituitary-adrenal system and the reticular formation. (tr-auth)

**706** BEHAVIOR OF ALKALINE PHOSPHATASE UNDER THE INFLUENCE OF LOCAL IRRADIATION OF BONES. Wawrzkiewicz, M. (Inst. of Obstetrics and Gynecology, Wroclaw). Radiobiol.-Radiother.; 14: No. 4, 427-434(1973).

Alkaline phosphatase activity was determined in the femur and femural bone marrow of rats irradiated locally with single x-ray doses of 100 to 1000 R. Measurements were made 1, 3, and 14 days after irradiation. Doses up to 400 R were found to cause a transitory increase in the enzyme activity of bones. A significant inactivation of alkaline phosphatase in the bone marrow was seen 3 and 14 days after administration of 700 R and invariably following the dose of 1000 R. Regeneration of the osseous and bone marrow tissue that depends on the height of doses used is related to the increase in alkaline phosphatase in the osseous and bone marrow tissue enables an early diagnosis of post-radiation bone injuries. (auth)

**707** COMPLEMENT CONSUMPTION IN NORMAL FRESH SERA BY DOUBLE CULTURE PARAMAECIUM CAUDATUM AND AEROBACTER CLOACAE COMPARED WITH SURVIVAL AND BODY WEIGHT CHANGES IN IRRADIATED RATS. Cabadaj, S.; Praslicka, M.; Porazikova, T.; Chlebovska, K. (Univ., Kosice, Czech.). Radiobiol.-Radiother.; 14: No. 4, 435-440(1973).

Rats were examined by test of complement consumption by double culture Paramaecium caudatum and Aerobacter cloacae on the 4th day after irradiation with 620 R. Survival and body weight changes were more favorable in rats with an intensive reaction (relatively high NMHD values) than in rats with a weak reaction. Prognostic significance of the used reaction is documented in radiation sickness in rats at six different experimental series with the total number of 745 animals and at 100 women with uterine or breast cancer. (auth)

**708** EFFECT OF PRELIMINARY GAMMA IRRADIATION ON THE DAMAGING ACTION OF VINBLASTIN ON THE MICE BONE MARROW CELLS. Baisogolov, G. D.; Konoplyannikov, A. G.; Khenkin, E. V. (Scientific-Research Inst. of Medical Radiology, Moscow). Med. Radiol.; 18: No. 9, 53-57(Sep 1973). (In Russian).

Albino mongrel mice were experimented on. The possibility of intensification of the damaging action of vinblastin on the population of the cells of the bone marrow by means of a preliminary one-time or fractional gamma irradiation was shown. (auth)

**709** EFFECT OF IRRADIATION ON AMINO ACID IN VITRO INCORPORATION IN THE COURSE OF LIVER REGENERATION. Tasheva, B.; Markov, G.; Tsanev, R. (Central Biochemistry Lab., Sofia). Z. Naturforsch., 28C: No. 5-6, 313-315 (1973).

The in vitro incorporation of $^{14}$C-leucine by rat liver microsomes is studied under four different physiological states: normal liver of adult rats; liver irradiated with 4,000 rads of $^{60}$Co $\gamma$ rays; liver after partial hepatectomy; and regenerating liver in preirradiated rats 2, 5, 12, and 24 hrs after treatment. Both irradiation and partial hepatectomy, when applied separately, stimulate the endogenous activity of microsomes, whereas pre-irradiation abolishes the stimulatory effect in the early hours after partial hepatectomy. The results are in agreement with the concept that irradiation stimulates the operating synthetic program of the cell and inhibits cellular reprogramming. (GE)

**710** EFFECT OF LOW X-RAY DOSES ON THE CENTRAL NERVOUS SYSTEM. Vasculescu, T.; Pasculescu, G.; Papilian, V.; Serban, I.; Rusu, M. (Medizinisch Pharmazeutischen Instituts, Cluj). Radiobiol. Radiother.; 14: No. 4, 407-416(1973). (In German).

Following studies on the mechanisms of the biological effects of low x-ray doses on the central nervous system attempts were made, by the statement of changes in acid phosphatase, of changes in nucleic acid, and of morphological neuronal and extraneuronal changes, to check and to penetrate as well as possible the causal relations presumed in previous work between these three categories of the changes covered under irradiation conditions used. (auth)

**711** CHANGES OF HEPATIC FUNCTION AND MORPHOLOGY AFTER REPEATED LOCAL ACTION OF $^{60}$Co-GAMMA RADIATION ON THE UPPER RIGHT QUADRANT OF THE BODY (HEPATIC REGION). Svesnikov, A. A.; Amosov, I. S.; Bandurko, L. N.; Gileva, T. P. (Scientific-Research Inst. of Medical Radiology, Obninsk, USSR). Radiobiol.-Radiother.; 14: No. 4, 417-426(1973). (In German).

In experiments with rabbits the whole hepatic region (6 × 10 cm$^2$ field) was irradiated with tumor doses of 200, 300, 400, or 500 rads each and a part of this region (3 × 5 cm$^2$ field) with 600, 1000, or 1500 rads up to a total dose of 6000 rads, respectively. Besides the liver the adjacent parts of stomach, intestine and of the deeperlying soft part tissues lay unavoidably in the radiation field. Protein function, hepatic secretion and excretion, as well as fermentative activity of blood-serum were examined. In irradiation of the hepatic region with partial doses of 200 rads up to the total dose of 6000 rads, disturbances of the protein function of the liver were only found. In irradiation with 300 rads each, all examined hepatic functions were disturbed; there were, however, no permanent changes. A dose below 400 rads in irradiation of the whole hepatic region up to a total dose of 6000 rads can be regarded as maximally tolerable, because irreversible changes developed after 400 rad single dose leading to the animals' death. In the irradiation of a part of the liver this dose was 600 rads. In the beginning a mild leukopenia of the animals was observed; excretion was disturbed and alkaline phosphatase activity was decreased. At the climax of the disease, leukocyte count decreased still more; erythropenia and thrombopenia developed; the animals slackened, refused to take food, body weight highly decreased and a part of the animals died. In the examination of the hepatic function, a further impairment of excretion, decrease in total protein concentration, disturbed ratio of protein fraction in the bloodserum, and a severe disturbance of the antitoxic hepatic function were found. Morphologically, destruction of a great part of hepatocytes, lysis of their nuclei, discomplexation of liver-cell trabeculae, and parenchymal focal necroses occurred. In the surviving animals the disturbed functions recovered at the third month after irradiation had finished. (auth)

**712** EXPERIMENTAL STUDIES ON FACIAL ABNORMALITIES. Grivu, O.; Muresan, D.; Bratu, E. (Faculte de Etomatologie, Timisoara, Roumania). Rev. Port Estomatol Cir. Maxilofac; 12: 77-83(1972). (In French).

The role of x rays as a teratogenic factor was studied experimentally in female white rats irradiated in the eleventh day of pregnancy with a single dose of 200 R. The facial and eye abnormalities resulting in the baby rats were described. The simultaneous localization at the level of the eye and the facial bones was discussed. (JSR)

**713** POST-IRRADIATION VASCULAR INJURY AND ACCELERATED DEVELOPMENT OF EXPERIMENTAL ATHEROSCLEROSIS. Upadhaya, B. R.; Chakravarti, R. N.; Wahi, P. L. (Post Graduate Inst. of Medical Education and Research, Chandigarh, India). Indian J. Med. Res.; 60: No. 3, 403-408(Mar 1972).

An experiment was conducted in albino rabbits to elucidate the effect of focal x irradiation on the aorta and heart in the initiation as well as aggravation of atherosclerotic lesions. Two groups were fed cholesterol in olive oil for a period of 31 days and one of these groups was also given focal x irradiation in the beginning of the experiment. It was observed at the end of the experiment that the frequency incidence, extent, intensity, and morphological complications were significantly greater in animals subjected to x irradiation and cholesterol feeding as compared to those given cholesterol alone. The determining factor for this change between the two groups appeared to be focal vascular trauma produced by x irradiation. (auth)

**714** SITE OF IMPAIRMENT OF OXIDATIVE PHOSPHORYLATION IN IRRADIATED RATS. Alexander, K. C.; Aiyar, A. S.; Sreenivasan, A. (Bhabha Atomic Research Centre, Bombay). Biochim. Biophys. Acta; 283: 206-216(17 Nov 1972).

There is a significant inhibition of liver mitochondrial oxidative phosphorylation at 72 h following whole-body x irradiation of rats with a dose of 800 rad. The three sites of phosphorylation coupled to electron transport show differential sensitivities to radiation, the terminal site being far more affected than the other two. Studies on NAD$^+$ reduction by reversal of electron flow, with the energy for the process being derived from the oxidation of ascorbate-tetramethyl-p-phenylenediamine, suggest that the formation of high-energy intermediates is not interfered with by irradiation. On the other hand, there is 2-fold evidence in favor of an impairment of the transphosphorylation function. Thus, by reconstitution studies, the activity of coupling factor F$_1$ is found to be greatly decreased in irradiated rat livers. With ATP as an energy source, phosphorylating submitochondrial particles from livers of irradiated rats show a lower rate of reduction of NAD$^+$. The site-specificity of the radiation effect is discussed in relation to current concepts of oxidative phosphorylation. (auth)

**715** NUKLEINOVYYE KISLOTY I BELKI V ORGANIZME PRI LUCHEVOM PORAZHENII. (Nucleic Acid and Protein in the Organism with Radiation Injury). Moscow; Meditsina (1972). 408p.

Investigations of impairments of the metabolism of the key substrata of life, nucleic acids and proteins, during radiation sickness in animals and humans are reviewed. The analysis of the mechanism of postradiation impairments of DNA and protein metabolism presented is important for understanding the pathogenesis of radiation injury and, therefore, for developing rational therapy and prophylaxis for this illness, and it is also of general biological significance for carcenogenesis, aging, and genetic impairment. (HLW)

**716** EFFECTS OF 15-MeV NEUTRONS ON CAPILLARY ENDOTHELIUM IN THE RAT. Broerse, J. J.; Reinhold, H. S.; Buisman, G. H.; Engels, A. C. (Radiobiological Inst. TNO, Rijswijk, Netherlands). Radiat. Res.; 56: No. 1, 180-185(Oct 1973).

For the application of fast neutrons in radiotherapy, it is important to evaluate the responses of various types of normal tissues in comparison with responses of experimental tumors after fast-neutron and x-irradiation. For rapidly proliferating cell-renewal systems such as the intestinal tissue, skin, and the immunohematopoietic system, extensive information is available on the RBE values as a function of dose or dose per fraction for various neutron beams. Only recently have quantitative studies been initiated on the response of slowly proliferating cell-renewal systems such as the vascular endothelium, which are considered to be dose limiting in clinical radiotherapy. Results concerning the vascular proliferation in subcutaneous tissue after irradiations with collimated beams of 300-kV x rays and 15-MeV neutrons are presented. For neutron doses between 250 and 500 rad, it has been observed that the RBE varies only slightly from 1.9 to 1.8. These studies indicate that the RBE values for effects of 15-MeV neutrons on the capillary endothelium are similar to the RBE values obtained for skin and intestinal epithelium and confirm that, in this dose range, the overall gain factor $RBE_{tumor}/RBE_{normal\ tissue}$ will be 1.2 to 1.3. (auth)

**717** EFFECT OF SOME CYTOSTATICS ON TYROSINE AMINOTRANSFERASE ACTIVITY IN RAT LIVER. Popov, P. G.; Kavkakirova, S. V.; Belokonskii, I. S.; Golovinskii, E. V. (Higher Military Medical Inst., Sofia). Acta Biol. Med. Ger.; 29: No. 6, 751-755(1972).

The cytostatics cyclophosphamide, 6-mercaptopurine, and amethopterine give a late maximum of tyrosine aminotransferase (TAT) activity (at the 72nd hour after their application), which is analogous to that observed after x-irradiation and is probably due to common pathogenetic mechanism. Cyclophosphamide and 6-mercaptopurine bring about also an early maximum (at the 4th hour), followed by a full return to normal values, so that TAT shows a biphasic curve analogous to that after x-irradiation. The second maximum (at the 72nd hour) after application of the aforementioned cytostatics is also observed in adrenalectomized animals. (auth)

**718** DISAGGREGATION OF POLYSOMES IN RAT THYMUS FOLLOWING WHOLE-BODY X IRRADIATION. Saroja, S.; Patil, M. S.; Sreenivasan, A. (Bhabha Atomic Research Centre, Bombay). Indian J. Biochem. Biophys.; 8: No. 4, 254-256(Dec 1971).

Polysomal profiles of the rat thymus examined at 18 and 48 hr following whole-body exposure to x rays (600 R) exhibited shifts from heavier aggregates towards monosomes. These changes were accompanied by significant increase in alkaline ribonuclease (RNase) activity with concomitant decrease in alkaline RNase inhibitor levels. The results suggest that disaggregation of polysomes after irradiation may be the consequence of activation of alkaline RNase resulting from the fall in the levels of the inhibitor. (auth)

**719** TEMPLATE ACTIVITY OF LIVER CHROMATIN IN RATS FOLLOWING WHOLE-BODY EXPOSURE TO X IRRADIATION. Subba Rao, M. N.; Netrawali, M. S.; Pradhan, D. S.; Sreenivasan, A. (Bhabha Atomic Research Centre, Bombay). Indian J. Biochem. Biophys.; 8: No. 4, 257-262(Dec 1971).

Synthesis of RNA is stimulated in rat liver during 4 to 24 hr following whole-body exposure to 1000 R x irradiation. At these time intervals, both $Mg^{2+}$-activated and $Mn^{2+}/(NH_4)_2SO_4$-activated reactions by isolated liver nuclei are enhanced. Template activity of isolated liver chromatin, as measured by exogenous liver RNA polymerase, was found to be significantly amplified during this post-irradiation period; at 18 hr, the activity is raised by about 50 to 60% above that in non-irradiated controls. These findings suggest that changes in transcriptive ability largely contribute to the stimulus in RNA synthesis and, in turn, protein synthesis in liver. (auth)

**720** REACTION OF A NERVE–MUSCLE PREPARATION WITH INTACT BLOOD SUPPLY TO LOCAL X IRRADIATION. Chepurnova, N. E.; Chepurnov, S. A.; Kozlov, V. V. Vestn. Mosk. Univ., Biol. Pochvoved.; 26: No. 5, 32-36(1971). (In Russian).

Nerve-muscle (gastrocnemius) preparations in 53 frogs were locally x-irradiated (10 kR). Irradiation in the region of the electrodes used for stimulating the preparation resulted in increased excitability. With repeated irradiation, an increase in the threshold of muscle contraction was observed after each irradiation. Cutting of the sympathetic nerves on one side, the intact side acting as a control, did not change the effect of the irradiation. This indicates that the somatic system is the one affected. It is assumed that the radiation affects the nerve endings in the muscles. (TTT)

**721** RADIOCYTOGENETIC EFFECTS ON BONE MARROW CELLS OF OPOSSUM IN VIVO. Prasad, N.; Bushong, S. C.; MacIntyre, R. S. (Baylor Coll. of Medicine, Houston, TX). Can. J. Genet. Cytol.; 15: No. 1, 123-126(Mar 1973).

Bone marrow cells of the opossum, Didelphis virginiana, were examined 24 hr following a whole-body $^{60}Co$ radiation dose of 100, 300, 500, and 700 rads. Analysis of the number of chromosomes and the chromosomal aberrations resulted in a radiation sensitivity of 0.000605 aberrations/cell/$rad^2$ for single-hit and multihit type damage respectively. (auth)

**722** AGE DYNAMICS OF HISTAMINE ACCUMULATION IN TISSUES AND ITS REACTION TO SOME EXTERNAL INFLUENCES. Maksutov, K. M.; Sudyakina, G. G.; Kur'yanova, R. I. Sov. Zdravookhr. Kirg.; 4: 34-38(1970). (In Russian).

Histamine accumulation in the tissues at different ages and quantitative changes in histamine reserves in the tissues as a result of a number of factors were evaluated. White rats whose ages ranged: 1 to 3 days, 6 to 7 days, 16 to 17 days, 30 days, 90 days, and 1.5 to 2 yr, were selected from both sexes for these experiments. The external factors whose effects were to be measured were reserpine (pharmacological), 600 R ionizing radiation (presumably x radiation) (physical), and high altitude residence (hypoxia). The effect of the radiation was a lowering of the histamine level in the lung and stomach tissues from the first day after exposure onward. The effects of the drug and hypoxia are discussed. (KSW)

**723** EFFECT OF IONIZING RADIATION ON THE GLUTATHIONE REDUCTASE–GLUTATHIONE PEROXIDASE EQUILIBRIUM. Stefan, M. (Inst. of Normal and Pathological Physiology, Bucharest). Rev. Roum. Physiol.; 8: No. 5, 423-429(1971). (In French).

In the erythrocytes of x-irrradiated mice (50, 100, 250, 500 R, single dose, whole-body), the higher doses caused a decrease in the glutathione peroxidase activity the first hour after the irradiation, and values remained low for the 5 days of the experiment. The effect increased with increasing dose. With 50 R there was a slight activation at first but a rapid return to normal. Glutathione reductase, after a slight initial rise, was inhibited by the higher doses, but with the 50 R dose the values remained higher than in the controls. The importance of glutathione and the enzymes responsible for its oxidation and reduction in the red cells following damage by ionizing radiation is discussed. (TTT)

**724** ACUTE RADIATION DEATH OF MAMMALS EXPOSED TO LARGE RADIATION DOSE. 2. Morphological Changes in Central Nervous System Death. Kimura, Y. (Keio Univ., Tokyo). Keio Igaku; 50: No. 4, 337-352(Jul 1973). (In Japanese).

To elucidate morphological changes of the central nervous death due to large doses of irradiation (5,000 to 80,000 rad), electron microscopic studies were performed on tissues of the cerebrum and cerebellum exposed to x rays of 6 MeV linear accelerator. The dd-strain male mice, 5 to 6 weeks old, were used. After irradiation of 5,000, 10,000, and 40,000 rad, the intracellular swelling of astrocytic processes and the damage of vasculoastrocytic unit were observed from 0.5 hrs to 72 hrs. Different sorts and degrees of changes, such as pyknosis, chromatolysis, cloudy swelling, tigrolysis, and clear swelling of mitochondria in both nucleus and cytoplasm of various cells (neurons, neurogliocytes, and granule cells) in cerebrum and cerebellum were observed in dependence on exposure dose at different time lapses after irradiation. Moreover, destruction of cell membranes of neurogliocytes and granule cells were observed. Especially, granule cells were more radiovulnerable than other cells. In the irradiation of 5,000 and 10,000 rad, not only destruction of both presynaptic cell membranes and limiting membranes of neuroglia, but also increase in number of the synaptic vesicles were observed at 0.5 hrs after irradiation. However, in the irradiation of 40,000 rad, decrease in number of the synaptic vesicles was observed from beginning and was intensified with lapse of time. After irradiation of much higher dose (80,000 rad), no apparent morphological changes in the central nervous system were observed during extremely short lapse of time until the death. (auth)

**725** CORRELATIVE ACTION OF RADIATION AND BLEOMYCIN ON THE SOLID TUMOR HEPATOMA ASCITES AH109A. Nagase, T. (Keio Univ., Tokyo). Keio Igaku; 50: No. 4, 327-335 (Jul 1973). (In Japanese).

Basic experiment on the correlative action of radiation and bleomycin was repeated three times with hepatoma ascites AH 109 A transplanted to Donryu rat 10 to 13 days after transplantation. A $2 \times 10^6$ (0.2cc) dose of hepatoma ascites were transplanted to the inguinal subcutis of Donryu rats 7 weeks old. A significant tumor growth inhibition was observed in each group treated with radiation of 1,000 rad or bleomycin 150 mg/Kg alone. Radiation of 1,000 rad and bleomycin 150 mg/Kg showed an equal efficiency. In the group treated with radiation of 500 rad and bleomycin 75 mg/Kg combinedly, a similar growth inhibition to those in both groups of radiation 1,000 rad alone and bleomycin 150 mg/Kg alone was observed, which result exhibits the additive action existing between radiation and bleomycin. There was a significant difference in the growth inhibition between the combination group of radiation of 1,000 rad and bleomycin 75 mg/Kg and each group treated with radiation of 1,000 rad alone or bleomycin 150 mg/Kg alone. Such result also demonstrates the additive action existing between radiation and bleomycin. In comparing each group of radiation of bleomycin alone, or the combination of those two with the control, a significant life prolongation effect was demonstrated in the former three groups. (auth)

**726** CANCER RADIOTHERAPY BY COMBINED USE OF RADIOPROTECTORS AND A RADIOSENSITIZER. Ohshima, T.;

Tsukiyama, I. (Tokyo Teishin Hospital). Nippon Igaku Hoshasen Gakkai Zasshi; 33: No. 4, 351-359(Apr 1973). (In Japanese).

Subcutaneous or intraperitoneal administration of 1-cysteine, 1-cysteine-d-glucose, MEA, or AET raised the survivals of male mice and decreased a loss of body weight from single or fractionated x irradiation. Among the SH compounds, AET is the most effective, and MEA is the next. In rats bearing Yoshida sarcoma, 5-flourouracil (5FU) was found to be effective as a radiosensitizer in radiation-induced depression of mitotic index of Yoshida sarcoma. Administration of MEA or 1-cysteine failed to alter the reduction of mitotic index of the sarcoma cells in rats treated with 5FU and x rays. This suggests that two SH compounds did not protect tumor cells from combined effects of 5FU and x rays. If the SH compounds exerted protective effects on normal tissues of rats, the effective killing of tumors may result in prolongation of survival times of rats bearing Yoshida sarcoma. However, the present experiments showed that the SH compounds did not prolong the survival time of the tumor-bearing rats. (auth)

**727** ELECTRON MICROSCOPIC STUDY ON RADIATION INJURY OF THE RAT LUNG WITH EMPHASIS ON THE REACTION OF CLARA CELLS. Nishida, T. (Jikei Univ., Tokyo). Tokyo Jikeikai Ika Daigaku Zasshi; 87: No. 5, 885-903(Sep 1972). (In Japanese).

Six male rats of Wistar strain weighing between 300g and 350g were used. A total irradiation of 651 R was given to each rat and the histological and ultrastructural changes of the lungs were observed at various intervals (1 hr., 6 hrs., 24 hrs., 3 days, 5 days, and 7 days). Early morphological changes observed at 1 and 6 hrs. were composed of endothelial swelling of alveolar capillaries, proliferation of type B alveolar epithelia, and proliferation of bronchiolar epithelia. Hemorrhagic pneumonitis appeared on the 5th day, when destruction of the blood-air barrier was observed electron microscopically. The swollen and proliferated type B alveolar epithelia demonstrated mitochondrial swelling, increased swollen osmiophilic bodies and ruthenium red positive substance on their surface. This fact suggests a possible correlation between osmiophilic body and so-called surfactant. On observing the respiratory bronchiolar wall, various changes of organelles together with secretory figures were found in the Clara cells. Transitional figures between Clara cells and type B alveolar epithelia were seen in the peripheral bronchioles. Ruthenium red positive substance, indicative of surfactant, was detected on the superficial layer of the alveolar wall at 6 hours, 3 days, and 5 days following irradiation. Further studies are necessary for the identification and significance of surfactant. (auth)

**728** RADIATION-INDUCED ABNORMALITY AND GROWTH DISTURBANCE IN THE MOUSE FETUS. Ueda, K.; Yoshizawa, Y. (Tokyo Univ.). Igaku No Ayumi; 84: No. 13, 760-770(Mar 1973). (In Japanese).

Six hundred and forty pregnant mice of ddY strain with the mean frequency distribution of 9.41 ± 2.30 litter size and 6,020 of their fetuses were examined in the experiment. Pregnant mice with fetuses at the gestation age between 7 to 13 days old were irradiated with 200 R (3.3 R/min) of gamma radiation at 2 pm, 7 pm, and 12 am respectively except those with 11-day-old fetuses who received 200 R of irradiation at 4 am, 9 am, 2 pm, and 12 am. In order to obtain correlation between the rate of abnormality in the limbs and radiation dose, 11-day-old fetuses were irradiated with 75, 100, 150, 200, 250, and 300 R for 1 hr. respectively. All of these irradiated groups of fetuses were taken from the maternal body and observed by microscopy. Abnormality appeared first in the forelimbs of the 11-day-old fetuses followed by abnormality found in the hindlimbs. Bradyphalangia was observed in 50% of the 11-day-old fetuses, while congenital anomalies of the hand and fingers were observed in the 9 am, 2 pm, and 7 pm irradiated groups. The rate of abnormality and body weight showed radiation dose dependency. One hundred percent abnormality was observed in the fetuses with 250 R of irradiation. Changes in fetus body weight was in inverse proportion to the rate of abnormality. Ossification of the caudal vertebrae started around 17 days old since gestation in the 11-day-old irradiated fetuses in which correlation between ossification and body weight was recognized. In the groups received with 50 μg and 100 μg of Cd intraperitoneally combined with irradiation, maternal death and abortion or premature delivery were observed. Even in the surviving animals, the death rate of fetuses increased. When saline solution was administered intraperitoneally to the pregnant mice with 200 R of irradiation, the rate of abnormality increased and further increased with Cd administration. (JA)

**729** EFFECTS OF RADIATION ON RADIOIRON UPTAKE IN MOUSE ERYTHROCYTES IN VITRO. Hayakawa, J.; Tsuchiya, T.; Tamanoi, I. (National Inst. of Radiological Sciences, Chiba, Japan). J. Radiat. Res.; 14: No. 1, 9-17(Mar 1973).

The iron uptake in vitro by erythrocytes was examined as an indicator of radiation effects on erythropoiesis in mice. Erythrocyte suspensions were incubated with $^{59}$Fe, previously bound to serum for 3 hrs. at 37°C. The changes of the iron uptake within 48 hrs. following x irradiation of 25 R and 50 R showed biphasic patterns. The reduction of the uptake at 18 to 20 hrs. after irradiation correlated exponentially with the exposure doses from 25 R to 200 R. In animals irradiated with 200 R, the recovery from the radiation-induced depression of the iron uptake by the method in vitro was delayed by two days from that estimated by the iron uptake in vivo studies. Since the uptake in vitro is mostly due to young reticulocytes present in the erythrocyte suspension, the delay of two days in recovery seems likely to be attributed to the time required for erythroblasts in bone marrow and spleen to mature and release to blood as reticulocytes. The iron uptake in vitro reflects the reticulocyte counts, and can be a simple and reliable indicator for radiation-induced disturbances of erythropoiesis. (auth)

**730** EFFECTS OF MICROBIAL FLORA ON LEVELS OF COLONY STIMULATING FACTOR IN SERUMS OF IRRADIATED CFW MICE. Chang, C. F.; Pollard, M. (Univ. of Notre Dame, IN). Proc. Soc. Exp. Biol. Med.; 144: No. 1, 177-180(Oct 1973).

Germfree, specifically mono-associated with bacteria, and conventional CFW mice were evaluated for changes in serum CSF levels following 850 R whole-body x-irradiation. Gram-negative E. coli-monoassociated mice showed elevations of CSF levels similar to that in conventional mice. However, CSF levels in mice mono-associated with S. faecalis remained unchanged, as in germfree mice. In mice with bone marrow transplantations following x-irradiation, serum CSF levels were maintained at the level of untreated mice, which indicates that CSF levels are regulated by functioning bone marrow cells. The data also indicate that the changes in CSF levels that are associated with gram-negative bacteria may be due to the production of endotoxin, which is involved in levels of serum CSF; which, in turn, may play a role in regulating granulopoiesis. (auth)

**731** RADIOPROTECTION BY PHENYLHYDRAZINE: EVALUATION OF STEM CELL RADIOSENSITIVITY AND POTENTIAL STIMULATION OF THE RETICULOENDOTHELIAL SYSTEM. Smith, L. H.; McKinley, T. W. Jr. (Oak Ridge National Lab., TN). Proc. Soc. Exp. Biol. Med.; 144: No. 1, 130-133(Oct 1973).

The evidence presented indicates that radioprotection by phenylhydrazine is not associated with an increase in the in vivo radioresistance of hemopoietic stem cells (measured as endogenous spleen colony-forming units) nor with stimulation of the reticuloendothelial system. When the erythropoietic-stimulating effect of phenylhydrazine was quantitatively reduced, radioprotection was also reduced. This finding indicates that protection depends on induction of a hypererythropoietic state by the drug. (auth)

**732** HEMATOLOGICAL CHANGES AFTER PARTIAL-BODY OR WHOLE-BODY IRRADIATION IN MICE. Kojima, E.; Sato, F.; Tsuchihashi, S.; Nakamura, W. (National Inst. of Radiological Sciences, Chiba, Japan). Nippon Igaku Hoshasen Gakkai Zasshi; 33: No. 4, 344-350(Apr 1973).

Mice were given head, trunk, or lower body, or whole-body exposures to 500 R of x ray under anesthetic condition. Comparisons were made of the effects of these four groups of exposure on leukocyte, thrombocyte, and erythrocyte count in the circulating blood. The change in leukocyte count followed essentially the same pattern in all types of exposure, although the extent of the radiation induced reduction was more severe and the recovery delayed in order of whole, trunk, head, lower body group. The severity of thrombocyte depression occurred on 6 to 10 days after exposures. It was more marked in whole-body group than in partial-body groups. No significant reduction was detectable in erythrocyte count and hematocrit value after all types of partial-body irradiation. The results suggest that precursor cells of three cell lines distribute in general uniformly in the bone marrow throughout the body. (auth)

**733** QUANTITATIVE TECHNIQUE FOR MEASURING RENAL DAMAGE AFTER IRRADIATION. Phillips, T. L.; Ross, G. (Univ. of California, San Francisco). Radiology; 109: No. 2, 457-462(Nov 1973).

An experimental system in the mouse was used to measure the effects of radiation on the kidney. After removal of the right kidney, the left kidney was allowed to hypertrophy, was localized through the skin, and was irradiated with 300 kVp x rays. Mice were observed for 18 months. Death began at 2 months after irradiation, reached a peak between 6 and 10 months after irradiation, but continued for up to 18 months. The major histological change was complete loss of the proximal and distal convoluted tubules. The $LD_{50}$, calculated from data for 6 to 16 mo. after irradiation dropped from 2358 rads at 6 mo. to 1300 rads at 16 mo. With 10 fractions, the pattern of death was similar except that the $LD_{50}$ at 8 mo. increased to 4709 rads. This study indicates that mouse kidney is extremely radiosensitive, renal damage accumulates for long periods of time, and significant recovery occurs with fractionation. (auth)

734 GRAFT-VERSUS-HOST REACTIONS IN MICE. IV. Thymus Cell Suppression of Antibody Formation. Bennett, M.; Sturgeon, M.; Engler, J. P. (Roswell Park Memorial Inst., Buffalo). Amer. J. Pathol.; 71: 135-150(Apr 1973).

The ability of transplanted marrow-thymus cell mixtures to generate antibody-forming cells in irradiated syngeneic or $F_1$ hybrid mice when immunized with sheep erythrocytes 18 hours later was determined. Much fewer anti-sheep plaque-forming cells (PFC) were detected in spleens of $F_1$ hybrid mice. Adrenalectomy, use of infant recipient mice, or preimmunization of donors or hosts did not prevent the suppression; the grafting of irradiated donor-type spleen cells (source of accessory cells) produced only an additive effect. Parental marrow and thymus cells were able to generate new precursors of PFC and specific inducer cells, respectively, in spleens of $F_1$ hybrid mice, as detected by two-step experiments utilizing parent-strain secondary recipient mice. The suppression depended on transferring parental strain thymus cells into $F_1$ hybrid mice and was seen irrespective of the marrow donor strain. When irradiated mice were immunized twice (on the day of transplantation and 4 days later), there was only marginal suppression of antibody production when marrow cells only or marrow plus thymus cells were transplanted. Thus, it appears that an excess of thymus-derived suppressor cells is generated on exposure to alloantigens and inhibit terminal differentiation of antibody-forming cells in a noncytotoxic manner. Mature PFC themselves were not the targets of suppression. The method of immunization probably determines the relative functional capacity of thymus-derived helper and suppressor cells. (auth)

735 X-RAYS AND THE RETINA OF THE PRIMATE FETUS. Rugh, R. (Columbia Univ., New York). Arch. Ophtalmol.; 89: 221-227(Mar 1973). (COO-3243-31).

Thirty pregnant monkeys (Macaca mulatta) were x-rayed (200 to 400 R) with radiations coned to the fetus between gestational ages of 60 to 145 days to study the retinal radiosensitivity, damage, and possible repair over a 23-month period. Irradiation even at 60 days resulted in extensive necrosis of retinal neuroblasts followed by reorganization with rosette formation. The most posterior region of the developing retina is the first to differentiate from neurectoderm to neurons, through the highly radiosensitive neuroblast stage. Differentiation proceeds anteriorly toward the ora serrata, with a parallel wave of radiosensitivity. No fetal retina can be completely damaged by a single x-irradiation. Attempts to reorganize show deficits resulting in bizarre formations of the retina that persist after birth. Clinicians are cautioned that the mammalian retina exhibits radiosensitive areas during the major part of gestation. (auth)

736 LEVEL OF SIALIC ACIDS IN THE LIVER AND MYOCARDIUM OF RATS IN LONG-TERM X IRRADIATION. Malashevich, Ya. V. (Inst. of Physics, Minsk). Vestsi Akad. Navuk BSSR, Ser. Biyal. Navuk; No. 4, 73-76(1973). (In Belorussian).

The sialic acids content of the livers and muscles of Wistar rats undergoing 10- and 20-week irradiation to a total dose of 50 R was studied. In several of the post-irradiation periods, the sialic acid contents deviated from normal but no pathological significance was apparent. Possible reasons for the changes in the levels in the irradiated organism are suggested. The nature of the disturbance is discussed and the possible role of the liver in the process is discussed. (tr-auth)

737 NONPARAMETRIC DETERMINATION OF MODIFYING FACTORS IN RADIATION ACTION. Kellerer, A. M.; Brenot, J. (Columbia Univ., New York). Contract AT(11-1)-3423. Radiat. Res.; 56: No. 1, 28-39(Oct 1973).

Modifying factors such as the oxygen enhancement ratio or the relative biological effectiveness of different radiation qualities are commonly derived from the comparison of dose-effect curves. In this approach, the statistical analysis is frequently made difficult or impossible by the uncertain influence of the scale of effect and of the method of curve fitting. To avoid this disadvantage, a method is used to establish the dose dependence of modifying factors and their confidence limits without the intermediate step of constructing dose-effect curves. The method is based on the comparison of effect levels in pairs of irradiated samples. The statistical tests suitable for this comparison of effect levels in typical experimental situations are considered, and the method is illustrated by its application to experimental studies of the opacification of the murine lens and to growth-reduction studies of Vicia faba. (auth)

738 HOMOLOGOUS AND HETEROLOGOUS HEMATOPOIETIC STEM CELLS. Matioli, G.; Niewisch, H.; Ashley, M. (Univ. of Southern California, Los Angeles). RES, J. Reticuloendothel. Soc.; 13: 238-262(Mar 1973).

Homologous spleen stem cells fail to grow in recipient mice because the immunologically competent cells (ICC) accompanying them inactivate the stem cell self-renewing microenvironment of the host spleen (SSM) by a graft-vs-host reaction (GVH). Homologous bone marrow stem cells grow normally in recipient mice because the GVH reaction against the host SSM is minimal. Cogrowth of homologous spleen and bone marrow is destructive to both stem cells because the spleen ICC ultimately destroys all the hosts SSM, which controls the self-renewal of all stem cells. Only a fraction of heterologous rat stem cells grows in mice utilizing that portion of the host SSM that escapes inactivation by the GVH reaction. There are certain stem cells that cannot grow in heterologous nonpermissive hosts. Their death rate is so rapid that a HVG or GVH reaction cannot be the primary cause of stem cell destruction. In order to explain these findings a hypothetical mechanism is proposed whereby stem cell growth is regulated by the coupling of the stem cell with radiation-resistant cells (sources), which provide the stem cell with a microdiffusing stimulus for self-renewal. Lack of stimulus recognition, coupling, and/or alteration of the sources by GVH reaction account for the growth kinetics of the homologous and heterologous stem cells so far tested. Experiments were conducted on stem cell growth using mice, rats, guinea pigs, hamsters, and rabbits. Recipient mice were lethally irradiated with $^{60}$Co. (HLW)

739 MECHANOCHEMICAL COUPLING OF RAT LIVER MITOCHONDRIA RADIOSENSITIZED WITH OLEYLAMINE. Dinescu, G.; Mihai, C. (Oncological Inst., Bucharest). Rev. Roum. Biochim.; 10: No. 1, 23-33(1973).

In order to enlarge the range of radiosensitizing drugs, the possibility of using oleylamine hydrochloride (OA.HCl) in this aim was investigated; the determinations were performed simultaneously on rat liver mitochondria from normal animals and from those treated with OA.HCl (55 mg/Kg), irradiated (800 R), and radiosensitized (800 R + OA.HCl). The following aspects of mitochondrial mechanochemical coupling were studied: pseudo- and energized swelling; sensitivity of the swelling induced by gluthathione; swelling–contraction cycles; respiratory control index; and content in cytochromes a, b, $c_1$ and c. The results show that radiosensitization with OA.HCl enhances the irradiation damage of these functions; this fact suggests that OA.HCl, especially when associated to irradiation, leads to some changes of the mitochondrial structure. (auth)

740 INFLUENCE OF IONIZING RADIATION ON CILIARY CELL ACTIVITY IN THE RESPIRATORY TRACT. Fujiwara, K.; Haakansson, C. H.; Toremalm, N. G. (Lunds Universitetssjunkhus, Sweden). Acta Radiol., Ther., Phys., Biol.; 11: No. 6, 513-520 (Dec 1972).

The effects of roentgen irradiation on the ciliary beat frequency of the trachea of rabbits were investigated in vitro by a light reflex method. Small doses produced only temporary changes in the beat frequency of the cilia but with large doses the movements were completely and permanently arrested. (auth)

741 THYMIC SHIELDING IN IRRADIATED MICE. Jaerplid, B. (Foersvarets Forskningsanstalt, Stockholm). Acta Radiol., Ther., Phys., Biol.; 11: No. 6, 536-544(Dec 1972).

A method for shielding of the thymus in mice during external irradiation is described. The results of the experiments indicate that thymic shielding during roentgen irradiation promotes the regeneration of extrathymic lymphoid tissues and the recovery of the number of lymphoid cells in the peripheral blood. (auth)

742 CONSIDERATIONS ABOUT THE STUDY OF TAURINE AND ITS USE IN RADIOBIOLOGY. Stigliano, G.; Testuzza, C. Ann. Med. Nav.; 76: No. 4, 359-367(1971). (In Italian).

The biosynthesis and metabolism of taurine in mice are considered. As the rate of elimination of taurine through the urine after irradiation seems to be correlated with therapeutic activity of the substance in the the treatment of some radiation effects, the basis for an experimental evaluation of the activity of taurine at lymphoid tissue level is outlined. (INIS)

743 MICROVASCULAR PERMEABILITY IN IRRADIATED RABBITS. Lundborg, G.; Schildt, B. (Univ. of Goteborg). Acta Radiol., Ther., Phys., Biol.; 10: No. 1, 311-320(Feb 1971).

The microvascular permeability of the endoneurial vessels of the tibial nerve was investigated in rabbits exposed to 1100-R x irradiation, corresponding to $LD_{50}$. Radiation damage was not detected following the tracer technique per se. The addition of slight ischemic injury, not capable in itself of causing permeability disturbances, revealed vascular damage during the first two weeks following irradiation. (auth)

**744** RBE OF FISSION NEUTRONS, 250 kV X RAYS, Cd(n, $\gamma$) AND $^{60}$Co GAMMA RAYS FOR INTESTINAL AND HAEMOPOIETIC DEATHS IN GUINEA-PIGS. Batchelor, A. L.; Corp, H. J.; Hulse, E. V. (Medical Research Council, Harwell, Eng.). Int. J. Radiat. Biol.; 24: No. 1, 15-24(Jul 1973).

A clearly defined intestinal syndrome was found in irradiated guinea pigs. After irradiation with fission neutrons, x rays, and Cd(n, $\gamma$) or $^{60}$Co gamma rays the LD50/6 was 755 rads, 1120 R, 1536 R, and 1718 R, respectively. The radiation dose needed to produce haemopoietic damage was much less, and the corresponding LD50/30 values were 247 rads, 447 R, 493 R, and 484 R, respectively. The LD50/30 was 7% lower for dorso-ventral than ventrodorsal neutron irradiation. RBE values were slightly greater for intestinal than for haemopoietic deaths. The respective values were 2.3 and 2.0 for neutrons, 1.5 and 1.1 for 250-kV x rays, and 1.1 and 0.9 for Cd(n,$\gamma$) gamma rays when compared with $^{60}$Co gamma rays. (auth)

**745** POSSIBILITIES OF TREATING ACUTE RADIATION SICKNESS. Denkov, V. Vet. Sb.; 71: No. 3, 33-37(1973).

Therapy with drugs, vitamins, and antibiotics does not lead to satisfactory results in acute radiation sickness. Blood transfusion is effective on irradiation of animals with sublethal doses, while on irradiation with lethal doses it is effective only when combined with other methods of therapy involving the use of drugs, vitamins, blood extenders, etc. Prushina, Tikhomirova, and Rozorenova showed that infusion of acid-hydrolyzed blood of cattle (L-103) increased by 50 to 60% the ratio of survival of dogs with acute radiation sickness that developed on irradiation with a dose of 600 R. They reported that replacement of 10% of the blood twice with poliglikin (a USSR dextran solution) in combination with other methods of treatment increased the ratio of survival of the dogs to 70%. Serafimov-Dimitrov showed in experiments on dogs irradiated with 450 R that transfusion of citrated blood diluted with an equal amount of a 6% dextran solution resulted in survival of the majority of the animals. Transplantation of bone marrow tissue (myelotransfusion) was also found effective in experiments with animals irradiated with lethal doses. Autotransplantation of bone marrow tissue resulted in a ratio of survival up to 90 to 100% and 80% for dogs and monkeys, respectively. Isotransplantation in the presence of immunological compatibility such as that which exists in inbred lines resulted in a survival ratio of 90 to 100%. Homotransplantation from animals of the same species in general produced a survival ratio of 60 to 70%, but endangered the life of the animals by reason of aftereffects due to immunological incompatibility. Heterotransplantation from animals of another species is effective only when the two species are related (e. g., rats and mice), but does not lead to a high survival ratio in any case. Immunological rejection reactions in heterotransplantation can be avoided if tissues of embryonal hemopoietic organs are transplanted. The number of bone marrow cells that exerts an optimum therapeutic effect has a range that varies with the species of animal. If an excessive amount of bone marrow is used in a myelotransfusion or the myelotransfusions are repeated too often hemopoiesis is inhibited and the animal dies. (JPRS)

**746** MORPHOLOGICAL ABNORMALITIES OF HEMATOPOIETIC CELLS INDUCED BY IRRADIATION. Hajducovic, S.; Szirmai, E. (Inst. for Nuclear Research, Vinca, Yogoslavia). J. Inst. Nucl. Eng.; 14: No. 4, 111-112(Jul 1973).

The development of radiation injury as related to the degree of maturity of hematopoietic cells was studied. Hematopoietic tissue from hens' eggs, at different levels of development (primary hematopoietic cell, promegaloblast, basophilic megaloblast) was exposed to $\gamma$ radiation to ascertain whether the same type or extent of radiation injury would be produced. The eggs were put in an incubator before being irradiated, allowing sufficient time for hematopoietic tissue to be developed. The intensity of irradiation was 50 R/min and the dose 700 R. Blood smears were made 24 to 48 hrs after irradiation. The observations showed that the developed morphological abnormalities varied considerably, depending on the incubation period prior to irradiation, that is, on the maturation stage reached at the moment of irradiation, the younger the cell the greater the diversity and extent of morphological disturbances. Irradiation 24 hr after incubation, that is, at the period of primitive hematopoietic cell formation, resulted in very extensive necrobiosis of the majority cell population. Irradiation 48 hr after incubation, that is, at the period of promegaloblast cell formation, resulted in a quite different hematological picture; the necrobiotic processes were only found amongst a very limited number of cells, but there was an abundant diversity of morphological abnormalities, this constituting the primary radiation injury. These morphological disturbances are summarised. Giant cells were prevalent, of different types. Changes observed in the nucleolus are also described. Chromosome aberrations were found. Irradiation 96 hrs after incubation, that is, at the period of basophilic megaloblasts formation showed the same type of injury, but to a very reduced extent, and giant cells were rare. Irradiation 120 hrs after incubation caused no particular morphological malformations. Attempts are made to relate the observed changes to the biochemical changes taking place during the maturation processes of the embryonic hematopoiesis. (UK)

**747** PROTECTIVE REACTIONS IN VACCINATED, IRRADIATED SHEEP. Krylova, N. A.; Nizametdinova, G. A. (Kazan Veterinary Inst.). Veterinariya; 11: 42-44(Nov 1971). (In Russian).

Immunization of sheep against strain 19 brucella causes an increase of the activity of properdin by 77.7% and the content of nucleotides of the blood 1.5 to 3 times on the 2nd and 5th day of vaccination. The agglutinin in the blood appears on the 7th to the 30th day. Single whole-body irradiation at doses of 300 R significantly reduces the activity of the properdin systems and the intensity of the immunity. Pyrogenol, introduced during the immunization and before irradiation, stimulates the natural resistance and also the immunological reactivity of the sheep. (tr-auth)

**748** MECHANISM OF ACTION OF EXCHANGE TRANSFUSION IN ACUTE IRRADIATION DISEASE. Deceva, Z.; Tomova, I. Eksp. Med. Morfol.; 11: 226-231(1972). (In Russian).

Experiments were carried out on 48 rabbits, irradiated with 1200 R of x rays. The methods of determining sex chromatin in leukocytes and autoradiography were used to examine the questions about participation of immunologic mechanisms in the unfavorable action of exchange transfusions on nonrejection of bone-marrow transplants in the irradiated animals, as well as the role of the stem cells of donor blood in the growth of transplants of bone-marrow after exchange transfusion. On the one hand it was found that an immunologic moment existed and on the other-that proliferation of stem cells of the donor blood was of no substantial significance under the given conditions. (auth)

**749** CARCINOGENESIS IN GERM-FREE ANIMALS. Pollard, M. (Univ. of Notre Dame, IN). Progr. Immunobiol. Stand.; 5: 226-230(1972).

The incidence and nature of spontaneous tumors, and of host responses following exposures to oncogenic chemical agents (3-methylocholanthrene-MCA, 7, 12 dimethylbenzanthracene-DMBA), to X-rays, and to viral agents (Gross leukemia, Rous sarcoma, and polyoma viruses) were determined. (auth)

**750** REGENERATION OF BONE MARROW IN RABBITS FOLLOWING LOCAL, FRACTIONATED IRRADIATION. Rubin, P. (Univ. of Rochester, NY). Cancer; 32: No. 4, 847-852(Oct 1973).

Serial studies were designed to examine the in-field regeneration of bone marrow in rabbit limbs treated with various fractionated dose schedules of irradiation. The total dose levels ranged from 2,000 to 5,000 rads with doses of 200 rads/day to 1000 rads/week. This schedule was followed to simulate the clinical setting. A double marker of $^{99m}$Tc-S colloid and $^{59}$Fe was employed to measure the activity in the reticuloendothelium (RE) and erythron compartments. The results of these studies are at variance with the published animal data, which utilized single exposures and indicated that suppression of bone marrow is permanent at doses exceeding 2,000 rads. The presented evidence indicates that bone marrow tolerance is greater for fractionated dose irradiation than for single exposures to the same levels. (auth)

**751** IN VITRO MODELS OF CELLULAR IMMUNITY: THE ROLE OF T AND B CELLS IN THE SECRETION OF LYMPHOTOXIN. Shacks, S. J.; Chiller, J.; Granger, G. A. (Univ. of California, Irvine). Cell. Immunol.; 7: 313-321(1973).

When normal murine spleen cells were treated with anti-theta serum and complement, they failed to produce LT or synthesize cellular DNA when stimulated in vitro with PHA. Theta-positive cells were responsible for LT production in spleens removed from x-irradiated and bone marrow- or thymus-reconstituted animals. Finally, spleens from congenitally athymic Nu/Nu mice failed to produce LT when stimulated with pokeweed mitogen or phytohemagglutinin. (auth)

**752** EFFECT OF PRE-RADIATION NUTRITIONAL STATE ON THE RECOVERY OF X-IRRADIATED RATS. Gabric, D.; Soljacic, M. Bull. Sci., Cons. Acad. Sci. Arts RSF Yougoslavie, Sect. A; 18: No. 4-6, 75-77(1973).

For three days prior to irradiation, one group of rats was fed normally, a second group was given 12% glucose solution, and a third group was given water only. All rats were then given a single 600 R whole-body dose of x radiation and all were given food ad lib during the post-radiation period. Observations were made on body weight and food and fluid intake for 13 days following irradiation. Results showed that fasted rats and those fed glucose solution recovered more successfully than those fed normally. Possible explanations for the results are discussed. (HLW)

**753** CHANGES OF ANTIOXIDATIVE ACTIVITY OF MOUSE LIVER LIPIDS DURING EXPERIMENTAL CARCINOGENESIS. Burlakova, E. B.; Molochkina, E. M. (Inst. of Chemical Physics, Moscow). Biofizika; 18: No. 2, 293-298(1973). (In Russian).

Studies were carried out on the changes of antioxidative activity (AOA) of mouse liver lipids under carcinogenic action of ortho-aminoazotoluene, 3,4-benzopyrene and $\gamma$-irradiation. AOA change under various types of carcinogenesis turned to have similar step-like character: a decrease at the first stage to some minimum (to 0, 6 of normal value) and then an increase 2 to 3 times exceeding the normal level. A connection is found between these changes and morphological stages of carcinogenesis. Codification antioxidative activity by means of injections of inhibitors of radical reactions at various stages of carcinogenesis changed the course of the process. The latter was either accelerated or slowed down due to the dose and time of inhibitor injection. This fact points to an important role of this physico-chemical characteristics of lipids (AOA) for carcinogenesis. (auth)

**754** RADIATION-INDUCED LEUKEMIA IN RATS: SYNERGISTIC EFFECT OF URETHAN. Myers, D. K. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Experientia; 29: No. 7, 859-861(15 Jul 1973).

One group of unirradiated rats was given weekly intraperitoneal injections of urethan; two groups were given whole-body x radiation alone; four groups were given various doses of x radiation plus injections of urethan at various time intervals. The tabulated results show that the leukemogenic effects of urethan and x radiation together were greater than the sum of their separate effects. However, the number of mammary and skin tumors induced by the combined treatment was less than after irradiation alone. (HLW)

**755** SURVIVAL AND ENDOGENOUS COLONY FORMATION IN IRRADIATED MICE GRAFTED WITH NORMAL OR INFECTIOUS MONONUCLEOSIS BONE MARROW. Louwagie, A. C.; Verwilghen, R. L. (Catholic Univ., Louvain, Belgium). Experientia; 29: No. 7, 861-862(15 Jul 1973).

Mice were exposed to 850 or 975 rad of whole-body radiation; three hr later mice were given normal human bone marrow, infectious mononucleosis bone marrow, or cells from malignant blood diseases. The surviving mice were killed at day 9 and the spleen nodules were counted. Some mice were also given antihuman antilymphocytic serum (ALS). In mice exposed to 975 rad, the highest survival was observed in mice grafted with infectious mononucleosis bone marrow, while none of the animals grafted with cells from malignant blood diseases survived 9 days. In mice exposed to 850 rad, grafting of normal or infectious mononucleosis bone marrow markedly decreased the survival. Endogenous spleen colonies were induced in all animals grafted with normal or infectious mononucleosis bone marrow. (HLW)

**756** RADIATION EXPOSURE OF THE LUNGS AFTER ENDOLYMPHATIC THERAPY. III. Dosimetric Distribution Study on Lungs of Rabbits After Endolymphatic Therapy. Stauch, G. W.; Makoski, H. B.; Magnus, L.; Heissen, E. (Univ. Bochum, Essen). Strahlentherapie; 145: No. 6, 644-651(1973). (In German).

Under endolymphatic therapy, fat embolism in the lung occurs relatively often due to radioactive Lipiodol. In man, the average radiation exposure of the lungs amounts to 164 to 830 rd and does not cause particular radiation damage, as far as could be observed until now. As in general only the average pulmonary dose can be specified, the fine distribution of the activity in the lungs of rabbits was tested autoradiographically after endolymphatic radionuclide therapy. This is necessary because considerable dose inhomogeneities after a slow intravenous injection have to be taken into account. The speed of injection was found to cause no significant differences of the activity in the lung. The radiation exposure of the individual pulmonary lobes showed a difference by a factor 2 to 3: the peak dose was found either in the upper, middle, or lower lobe. The fine distribution of the dose in the lung parenchyma was also considerably irregular, with peak doses of about the double of the average pulmonary dose. Besides the pulmonary radiation exposure caused by the fat embolism, an enhanced enrichment of the radioactive substance in the visceral pleura as well as in the bronchial wall was formed. Therefore, after endolymphatic radionuclide therapy in man, pulmonary doses reaching values that usually are applied to tumors, although in closely limited areas, are to be expected. If, therefore, an integral dose of 1,000 rd is measured in the lungs, in some pulmonary areas peak doses of 4,000 to 6,000 rd can be reached. Such pulmonary doses are not at all rare and must be taken into consideration when additional percutaneous irradiations of the lung or the mediastinum are given. Such doses may represent a contraindication for further radiation exposures of the lungs. Therefore, in the treatment of system diseases of the lymph nodes, the radiation exposure of the lung after endolymphatic radionuclide therapy should be kept extremely low, otherwise further radiotherapeutic measures will be hindered. (GE)

**757** HISTOTOPOGRAPHY OF PHOSPHATASES DURING THE DEVELOPMENT OF RAT RETINAS AND ITS DISTURBANCE BY X RADIATION. Schmidt, B. (Univ., Hamburg). Acta Anat.; 84: 161-177(1973). (In German).

Retinal development in the rat and reaction 24 h after 500 R x-irradiation was examined from birth to 15th day of life using histochemical reactions for acid phosphatase and for alkaline phosphatase. There was an accordance in localization and in increase of activity of acid phosphatase with the growth of neurites and dendrites. The histochemical differentiation takes place from the inner part of the retina to the outer part. The increase of activity of acid phosphatase at the time of growth of the dendrites and neurites was compared with the increase of acid phosphatase in the corresponding ganglion cells after irradiation of the brain, causing alteration of the white matter. Alterations of the retina causing deformity were produced only after irradiation of rats up to the 3rd day after birth. Structures which showed activity of alkaline phosphatase at $p_H$ 9,4 were related to Müller's cells, astrocytes, and blood vessels. The difference in time between the histological development of the blood vessels and beginning of activity of alkaline phosphatase was discussed. There were no changes in activity of acid or alkaline phosphatase after 500 R x-irradiation. (auth)

**758** EFFECT OF WHOLE-BODY IRRADIATION WITH X RAYS ON THE FORMATION OF IMMUNITY IN TETANUS TOXIOD-IMMUNIZED MICE. II. Secondary Immunity to Tetanus Toxin. Galazka, A. Med. Dosw. Mikrobiol.; 24: 247-253(1972). (In Polish).

White mice were twofold immunized with various doses of adsorbed tetanus toxoid and irradiated with a dose of 500 R at various time intervals before and after the second immunization. The secondary response of the animals was more resistant to irradiation than the primary one. It was found, however, that antibody synthesis was disturbed in mice irradiated 1 to 2 hours prior to the second immunization. The detrimental effect of irradiation was found to depend to a high extent on antigen dose used for the first, and not the second, immunization. (auth)

**759** EFFECT OF VARIOUS DOSES OF CITRIPHOS ON THE SURVIVAL OF MICE IRRADIATED WITH A LETHAL DOSE OF X RAYS. Nikolov, I.; Pantev, T.; Bokova, N. Rentgenol. Radiol.; 12: No. 2, 126-129(1973). (In Russian).

Prophylactic intraperitoneal administration of citriphos (cysteamine adenosinetriphosphate) to male mice in a dose of 700, 500, and 300 mg/kg 15 min before irradiation of the animals with x rays in a dose of 700 R resulted in survival of 79, 90, and 95% of the animals, respectively, until the 30th day after irradiation, whereas none of the control animals survived until the 30th day. Therapeutic administration to mice of citriphos in a dose of 500 and 700 mg/kg (divided into four equal parts) 5, 15, 30, and 45 min after irradiation did not increase the rate of survival until the 30th day vs. that of 0% controls. However, it raised the mean length of the time of survival to 7.0 to 7.9 days from 6.0 days for controls. While most of the control animals died on the 5 to 6th day (gastrointestinal death), the lethality curve for the animals treated therapeutically extended to the 10 to 13th day, showing two peaks, one on the 5 to 6th day (gastrointestinal death) and another on the 10 to 13th day (bone marrow death). Reports in the literature to the effect that citriphos has a therapeutic action are due to the fact that the experiments were carried out on rats. Unpublished work by the authors of this article showed that this substance actually has a therapeutic effect on irradiated rats. (JPRS)

**760** HISTOCHEMICAL STUDY OF THE EFFECT OF A DEUTERON BEAM ON THE DENTAL GERM. Manfredi, E. E.; Itoiz, M. E.; Cabrini, R. L.; Mayo, J. (Univ., Buenos Aires). Riv. Istochim., Norm. Patol.; 17: 97-103(Apr 1972).

The histochemical behavior of several enzymes in irradiated rat dental germ was analyzed. A 4 × 4 mm. deuteron beam was employed with a 500,000 rad. doses. Post irradiation times were 1 and 4 days. In all cases an enzymatic decrease was observed that became evident after 4 days. The dental germ showed higher irradiation sensibility than the surrounding bone tissue. Some enzymes revealed reacting cells within the papilla that were interpreted as histiocytes. Dentin formation towards the papilla occurred with inverted polarity odontoblasts. Inversion did not affect enzymatic reactivity. (auth)

**761** COMBINED EFFECT OF RADIATION AND CHEMICAL CARCINOGENS IN FEMALE A × IF MICE. Flaks, A.; Hamilton, J. M.; Clayson, D. B.; Burch, P. R. J. (Univ. of Leeds, Eng.). Brit. J. Cancer; 28: No. 3, 227-231(Sep 1973).

Groups of mice were exposed to various doses of ionizing radiation on one occasion. X radiation was at doses of 500 rad whole body, 500 rad with the upper part of the body shielded, or 1000 rad with similar shielding. In two groups of animals, the bladder carcinogens dibutylnitrosamine (DBNA) and 4-ethylsulphonyl-naphthalene-1-sulphonamide (ENS) were administered 48 hrs after irradiation. Post mortem and histopathological examinations failed to show any significant lesion in the bladder of animals subjected to radiation per se. Furthermore, radiation did not influence the latent period or incidence of bladder tumors induced by DBNA and ENS. However, radiation shortened the latent period of mammary tumors and, in some groups, increased the incidence of such lesions. When radiation was combined with the chemical carcinogens there was a marked reduction in the incidence of mammary tumors. (auth)

**762** CHARACTERISTICS OF THE MUTAGENIC EFFECT OF RADIATION ON SEX CELLS IN NEWBORN MALE MICE. Fazylov, U. T.; Pomerantseva, M. D. (Inst. of Genetics, Moscow). Biol. Nauki; No. 9, 95-98(1971). (In Russian).

A comparative study was made of the genetic radiosensitivity of the primary sex cells of newborn and spermatogonic sexually mature mice. The frequency of reciprocal translocations was used as the indicator of genetic radiosensitivity. During x-ray irradiation of the gonocytes of the newborn and spermatogonic sexually mature males at dose of 20 to 400 R the frequency of reciprocal translocations increased linearly with the increase of the dose. The gonocytes are on an average three times genetically less radiosensitive than the spermatogones. (tr-auth)

**763** INCREASED EPIDERMAL DEOXYRIBONUCLEASE I ACTIVITY IN β-IRRADIATED GUINEA PIG SKIN. Irradiation Through the Hair, a Required Control. Tabachnick, J.; LaBadie, J. H. (Albert Einstein Medical Center, Philadelphia). Arch. Dermatol. Forsch.; No. 247, 65-71(1973).

Within 24 h after close clipping of guinea pig hair there is dramatic increase in epidermal deoxyribonuclease I (DNase I) and the enzyme can be washed from the skin surface with 0.14 M NaCl or from excised epidermis prior to homogenization. In order to study changes in DNase I activity as a result of β-irradiation injury it was necessary to irradiate through the hair of one flank with 4700 rep β ($^{90}$Sr$-^{90}$Y). These changes were compared with those after a contact dose of 3000 rep β given to the closely clipped skin surface on the other flank. Extracellular epidermal DNase I increased significantly on days 10 and 15 postirradiation in both flanks; however, there was a 3- to 4-fold greater concentration on the flank from which the hair had been clipped prior to irradiation. The possible mechanisms for the increase in epidermal DNase I are discussed. (auth)

**764** SIMPLE RAT RESTRAINING DEVICE FOR RADIOBIOLOGICAL STUDIES. Natarajan, S.; Nayak, N. A. (Inst. of Mathematical Sciences, Madras). Indian J. Radiol.; 26: No. 1, 36-37(Feb 1972).

A restraining device to hold four rats at a time, in their most comfortable position for a period of nearly two hours if necessary, in the radiobiological studies using x irradiation is necessary. Construction of the rat restrainer and the technique of restraining the rat on the rat restrainer are described. Advantages of using such a device in radiobiological studies are enumerated. (INIS)

**765** ROLE OF HUMORAL AND CELL-MEDIATED IMMUNITY ON THE RECOVERY OF CHICKENS FROM FOWLPOX VIRUS INFECTION. Morita, C. (Kitasato Inst., Chiba, Japan). J. Immunol.; 111: No. 5, 1495-1501(Nov 1973).

The influence of thymectomy and bursectomy followed by x irradiation in chickens on the recovery from fowlpox virus infection was examined. It was found that the virus titer in the lesions the 2nd week after infection was well correlated with the migration inhibition test of splenic cells. Healing time after the infection also was correlated with the migration inhibition test of splenic cells. These findings suggest that cell-mediated immunity plays a more important role in the recovery that does humoral immunity. However, the mechanism of humoral immunity was not excluded since the mortality was significantly higher in bursectomized-thymectomized chickens than in thymectomized chickens. (auth)

**766** SUGGESTED CORRELATION BETWEEN RADIATION-INDUCED IMMUNOSUPPRESSION AND RADIOGENIC LEUKEMIA IN MICE. Clapp, N. K.; Yuhas, J. M. (Oak Ridge National Lab., TN). J. Nat. Cancer Inst.; 51: No. 4, 1211-1215(Oct 1973).

The reduced incidence of reticulum cell sarcoma in RF mice with glomerulosclerosis (GLO) and the demonstration that GLO partly results from an immune response to wild-type virus-associated antigens have provided a means for the determination of the importance of radiation-induced immunosuppression in leukemogenesis. This finding of reduced leukemia risk in mice with GLO has now been extended to include the 2 radiation-induced types, thymic and myeloid. The incidence of radiation-induced leukemia increased with radiation dose in both GLO-positive and GLO-negative mice, but the presence of GLO was associated within each dose group with a twofold reduction in risk for each leukemia. Doses >100 rads suppressed the immune system and the development of GLO and thereby shifted a fraction of the animals from the low-risk (GLO-positive) group to the high-risk (GLO-negative) group. Since GLO is, at least in part in these RF mice, the product of an immune reaction against a virus-associated antigen, suppressing the ability to cope with leukemogenic virus-associated antigens (suppressing the immune system) contributed to the overall leukemogenic effectivness of radiation, at least for doses >100 rads. Since suppression of GLO development did not contribute in the lower dose range (≤100 rads) clearly the dose-response curve for radiation-induced leukemia in the RF mouse cannot be linear. (auth)

## *Invertebrates*

**767** (ORO-3329-9) EFFECT OF RADIATION ON MUCOSAL PHOSPHOLIPASE ACTIVITY. Progress Report. (Duke Univ., Durham, N. C. (USA). Dept. of Physiology and Pharmacology). Oct 1973. Contract AT(40-1)-3329. 11p. Dep. NTIS $3.00.

Experiments are planned on the parasitic nematode, Angiostrongylus cantonensis, which has a larval stage in the brain followed by migration and adult development in the lung. Heads of rats will be irradiated during the larval phase and the eventual reduction in lung reaction will be used as a measure of the sterilizing effect on the parasite. Progress is also reported on the following projects: estimation of the eosinophilic population of rat tissues; changes in the eosinophilic cell precursor compartment after drug treatment; the role of the reticuloendothelial system in steroid-induced eosinophenia; preparation of anti-eosinophilic sera; and studies on stomach eosinophils. (HLW)

**768** POST-RADIATION RECOVERY OF ADULT INSECTS. Abdu, R.; Sumarukov, G. V. Vestn. Mosk. Univ., Biol. Pochvoved.; 26: No. 5, 112-113(1971). (In Russian).

The viability of adult rice weevils irradiated with 3900 R ($LD_{50/25}$) was not affected by starvation for 1 day before or 1 day after the irradiation, but 2 days' starvation (1 before and 1 after) markedly decreased the viability of the insects. The irradiated insects had no dividing cells in the somatic organs. The recovery apparently reflects processes leading to normalization of the function of the cells that were irradiated. (TTT)

**769** NEW APPROACHES TO THE CONTROL OF HARMFUL INSECTS. Koshy, T.; Chandra, K. R. (Inst. of Nuclear Medicine and Allied Sciences, Delhi). J. Sci. Ind. Res.; 31: No. 10, 515-523(Oct 1972).

As the insects are becoming resistant to modern insecticides such as DDT and BHC, studies into new approaches to pest control have become necessary. These approaches are: insect biochemistry and mode of action of insecticides; biological control methods; methods using repellants and attractants; and integrated control methods. The studies in these approaches are reviewed. The use of radiotracer techniques in the study of the mode of action of insecticides is briefly described. In the biological control methods, the sterile male technique based on radiation sterilization is discussed. (INIS)

**770** SOME EFFECTS OF IRRADIATION ON THE TICK RHIPICEPHALUS APPENDICULATUS. Purnell, R. E.; Dargie, J. D.; Gilliver, B.; Irvin, A. D.; Ledger, M. A. (East African Veterinary Research Organization, Kabete, Kenya). Parasitology; 64: No. 3, 429-440(Jun 1972).

A series of experiments to study the effects of γ irradiation on the tick, Rhipicephalus appendiculatus, is described. It was intended to define the tolerance limits to irradiation of different stages of the tick so that a subsequent series of experiments could be carried out to study the effects on developmental stages of Theileria parva in the tick and also to explore the possibility of producing sterile male ticks in spite of the obvious difficulties of attempting to use this technique for tick eradication. (auth)

**771** PARTIAL ADDITIVITY OF THE MITOTIC DELAYS INDUCED BY SEPARATE γ IRRADIATION OF SEA-URCHIN EGGS AND SPERM. Rustad, R. C. (Marine Biological Lab., Woods Hole, MA). Int. J. Radiat. Biol.; 24: No. 2, 213-217 (Aug 1973).

Eggs and sperm of the sea-urchin, (Arbacia punctulate), were exposed to the same dose of $\gamma$ radiation in the dose range 0 to 20 KR. Normal or irradiated eggs were fertilized with normal or irradiated sperm. Mitosis was delayed to the same extent when either eggs or sperm exposed to the same dose were combined with a normal gamete. When irradiated eggs were fertilized with sperm previously exposed to the same dose, the mean mitotic delay was larger than when only one gamete was irradiated, yet there was very little overlap between the division times of zygotes containing one irradiated gamete and those with both gametes irradiated. The mitotic delay resulting from separate irradiation of sperm and eggs with a particular dose was the same as that resulting from irradiation of sperm alone with twice that dose. The division times of eggs exposed to a given dose and fertilized with sperm exposed to twice that dose did not overlap the division times of irradiated eggs fertilized with normal sperm, and there was only partial overlap of division times between populations derived from control and irradiated eggs both fertilized with sperm exposed to twice the dose of the eggs. It is argued that this would not have been the case if there had been no additivity of the effects of damage to the separate gametes. (UK)

**772** SUPPRESSION BY HYPOXIA OF DOSE-FRACTIONATION RECOVERY IN TENEBRIONID BEETLES. Griffiths, T. D.; Ducoff, H. S. (Univ. of Illinois, Urbana). Int. J. Radiat. Biol.; 24: No. 2, 203-206(Aug 1973).

Dose-fractionation studies were made with x-irradiated Tribolium castaneum larvae, Tribolium confusum adults, and Tenebrio molitor larvae. In experiments with T. castaneum larvae, it was found that if air were present between two exposures of 2.0 KR each, there was a rapid increase in survival as the interval between doses increased up to 6 hr, a slight increase between 6 and 8 hr, and a slower increase in survival with longer intervals. Recovery was absent if the larvae were kept under hypoxic conditions. Similar results were obtained with T. molitor larvae. The results obtained with T. castaneum larvae and T. confusum adults indicated that the inhibitory effect of hypoxia was reversible; significant recovery was obtained if the beetles were returned to air for at least 2 hr before the 2nd exposure. Larvae received a total dose of 4.0 KR and adults 7.2 KR. (UK)

**773** ATYPICAL RESPONSE TO RADIATION BY THE MUD SNAIL, NASSARIUS OBSOLETUS. Engel, D. W.; Davis, E. M. (National Marine Fisheries Service, Beaufort, NC). Int. J. Radiat. Biol.; 24: No. 2, 199-201(Aug 1973).

Groups of 30 mud snails (Nassarius obsoletus) were irradiated under aerobic conditions with doses of 0, 20, 30, 40, 50, 60, and 70 krads of $^{60}$Co$\gamma$ radiation at a dose-rate of 310 rads/min (± 10%). After irradiation, each group was removed from the irradiated water, subdivided into 10 animals per container and maintained at constant temperature (20°C) and salinity (30 0/00). Survival of the snails did not follow the sigmoidal relationship. Survival curves were biphasic and could not serve as a basis for $LD_{50}$ estimates. Survival at 30 krads was not only lower than at 20 or 40 krads, but mean survival time was shorter. Survival curves are presented for 30, 60, and 70 days after irradiation. It is suggested that the data indicate that the $LD_{50}$ 30-day dose must be in excess of 70 krads. (UK)

**774** SENSITIVITY OF TENEBRIO MOLITOR AND T. OBSCURUS TO GAMMA IRRADIATION. Brower, J. H. (Dept. of Agriculture, Savannah, GA). J. Econ. Entomol.; 66: No. 5, 1175-1179(15 Oct 1973).

Effects of gamma irradiation doses between 5 and 100 krad on all stages of Tenebrio molitor L. and T. obscurus F. appeared to be similar although T. molitor was more radiosensitive. Development of adults from eggs and larvae was prevented by 2.5 and 5 krad, respectively, but some adult T. obscurus emerged from pupae treated with doses as high as 30 krad, and some T. molitor at doses of 50 krad. Adult females of both species were more sensitive than males to the sterilizing effects of gamma irradiation, but sterility was complete at doses of 15 krad and above. Control of these 2 species appears feasible with the levels of irradiation currently approved for treatment of stored-grain insects in wheat and wheat flour. (auth)

**775** STERILIZATION OF JAPANESE BEETLES BY GAMMA RADIATION. Ladd, T. L. Jr. (Ohio Agricultural Research and Development Center, Wooster); Canfield, R. T.; Forgash, A. J. J. Econ. Entomol.; 66: No. 5, 1047-1048(15 Oct 1973).

Field-collected male and female Popillia japonica Newman were exposed to 0.87 to 64.5 krad of $^{60}$Co gamma rays. Calculated doses for 95% sterility were 8.4 krad for females and 4.4 and 5.2 krad for males in 2 separate tests. Increasing the doses of irradiation produced generally decreased longevity in both sexes. (auth)

**776** TOBACCO BUDWORMS: STERILIZATION, SEXUAL COMPETITIVENESS, AND SPERM TRANSFER OF MOTHS REARED FROM EGGS IRRADIATED WITH $^{60}$Co. Wolfenbarger, D. A.; Guerra, A. A.; Robinson, S. H. (Dept. of Agriculture, Brownsville, TX). J. Econ. Entomol.; 66: No. 5, 1067-1070 (15 Oct 1973).

Heliothis virescens (F.) moths, reared from eggs that were exposed to 1, 2, or 4 krad of gamma irradiation when they were 1, 2, or 3 days old, were partially sterilized: fertility was reduced as much as 82%. Both sexes of moths reared from eggs that were irradiated with 4 krad at 2 days of age were sexually competitive with untreated moths; however, sperm transfer was adversely affected. (auth)

**777** EVIDENCE FOR A SEX-LINKED HAPLO-INVIABLE LOCUS IN THE CUT-SINGED REGION OF DROSOPHILA MELANOGASTER. Lefevre, G. Jr.; Johnson, T. K. (California State Univ., Northridge). Genetics; 74: No. 4, 633-645(Aug 1973).

Many cytologically normal and rearranged cut mutants have been reported, but no known deficiency involves both ct and its close neighbor, singed. This fact prompted an investigation of the mutational response of the ct-sn interval. Approximately 24,000 $F_1$ female progeny of 7-day-old males given 2000 or 3000r x-ray exposures were examined for the presence of newly induced mutations at the Notch, carmine, ct, and sn loci. One sn, 2 cm-ct, 31 N, and 33 ct mutants were found, indicating that the frequency of recovery of ct mutants is much greater than that of either cm or sn, as high even as N. Among the $F_1$ female progeny were two deficiency mutants that expressed both cm and ct (separated by 21 bands), but none expressed both ct and sn (separated by only 14 bands). Of the 18 cytologically analyzed ct mutants, two proved to be deficiencies; neither extended farther to the right than 7C1. No reported ct deficiency extends with certainty farther to the right than 7C4. This fact, together with the scarcity of sn deficiencies, suggests the presence of a haplo-insufficient locus between ct and sn that prevents recovery of ct-sn deficiencies. The analysis of the deficiency component of Tp $sn^{S93}$, a short transposition which moves most of the ct-sn interval from 7BC to 8D, proved the existence, just to the left of sn, of a haplo-inviable locus that prevents the development of females heterozygous for its deficiency. A marked similarity between mutants at the N and ct loci was noted. (auth)

**778** COMPARISON OF THE EFFECTS OF FAR AND NEAR ULTRAVIOLET RADIATION AND THEIR PHOTOREACTIVATION ON SOME PROTOZOA. Samoilva, K. A.; Krylenkov, V. A. (Inst. of Cytology, Leningrad). Stud. Biophys.; 36-37: 191-203(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

A comparison of the action of far and near uv radiation on survival and division rate of paramecium caudatum and amoeba proteus was performed. Strong after-effects were observed. Both far and near uv used in isoeffective doses showed similarity in their action, but doses of near uv were 5 to 9 times greater than isoeffective doses of far uv. The effects of both types of uv decreased to the same extent by illumination of cells with visible light; terms and rates of the photoreactivation were similar too. Clones of p. caudatum and a. proteus showing an equal sensitivity to far uv demonstrated remarkable differences as regards the sensitivity to near uv. The ploidy factor was more significant for cell reaction to far uv. (auth)

**779** SEX-LINKED TRANSLOCATIONS, SEMISTERILITY, AND LINKAGE ALTERATIONS IN THE MOSQUITO AEDES AEGYPTI. Bhalla, S. C. (Univ. of Maryland, College Park). Can. J. Genet. Cytol.; 15: No. 1, 9-20(Mar 1973).

Seven sex-linked translocations were artificially induced and isolated in the mosquito Aedes aegypti. All translocations have passed through four generations. Each translocation heterozygote shows characteristic sterility with small variation. Egg hatches of the seven translocation heterozygotes ranges from 18% to 71%. Two translocations are $T_M$ type, i.e. linked to the M chromosome, and the remaining five are $T_m$ type, i.e. linked to the m chromosome. Possibilities of using both types of translocation for genetic manipulation of field population are discussed. The three linkage groups (I, II, III) were correlated to the three pairs of chromosomes (1, 2, and 3). For the first time in mosquitoes, translocations were utilized to correlate a specific gene to a particular segment of a chromosome. The blt locus was assigned to the small terminal segment distal to the secondary constriction on chromosome 3. (auth)

**780** EFFECTS OF CHRONIC BETA RADIATION FROM SIMULATED FALLOUT ON SPRINGTAILS, FOLSOMIA SP. (COLLEMBOLA). Styron, C. E. (Oak Ridge National Lab., TN). Health Phys.; 25: No. 3, 281-284(Sep 1973).

Population dynamics of laboratory cultures of Folsomia sp. (Collembola) exposed to beta radiation from $^{90}$Sr–$^{90}$Y simulated fallout were affected primarily by the sensitivity of fertility rates rather than by the sensitivity of adult mortality rates. Dose rates for adults estimated to constitute a lethal dose rate for 50% of the population in 30 days ($LD_{50/30}$) or in 60 days ($LD_{50/60}$) were nearly ten times as high as dose rates required to reduce fertility rates to zero. Recovery of fertility rates was not observed in these chronically irradiated populations. (auth)

**781** EFFECTS OF SINGLE X IRRADIATION ON THE REPRODUCTIVE PERFORMANCE OF FEMALES IN GAMMARUS DUEBENI. Hoppenheit, M. (Biologische Anstalt Helgoland, Hamburg). Helgolaender Wiss. Meeresunters.; 23: No. 4, 467-484(1972). (In German).

Effects of single exposures of x radiation on moulting, oviposition, and production of eggs and young in Gammarus duebeni females were studied under constant conditions of temperature (15°C) and salinity (10 per thousand). Groups of fifty females were each irradiated with doses between 65 and 2,500 R. Reduced egg-production rate could be established at doses down to 220 R; this is caused both by omitted ovipositions (down to 330 R) and by reduced brood size (down to 220 R). Differences were found between the number of eggs laid and the number of young discharged from the brood chamber at doses down to 490 R. After irradiation with 147 R or lower, no effect on fecundity or fertility could be established. Irradiation doses of 220 R or lower have a so-called beneficial effect, distinguishable by the irradiated specimens' higher survival rate, whereby the eventually reduced egg-production rate can be more than compensated by the higher number of live females and the resulting larger total amount of eggs produced. (GE)

## Radionuclide Effects (Internal Source)

*Refer also to abstracts 619 and 623.*

### Man

*Refer also to abstracts 369, 389, 622, 624, 627, 633, 662, 664, and 696.*

**782** (CONF-710567–, pp 43-71, PAPER 5) DOSIMETRY OF INTERNAL EMITTERS. Reddy, A. R. Aug 1971.

From seminar on recommendations of the international commission on radiological protection; New Delhi, India (12 May 1971).

Methods for estimations of radiation dose distribution of radionuclides in man following ingestion, inhalation, skin absorption, or uptake through wounds are reviewed on the basis of data included in ICRU publications issued between 1959 and 1968. The methods are based on data on the decay scheme of the radionuclide of interest, the solubility of the radioactive compound, and the metabolic pathway of the radionuclide in the human body. Equations are included for use in calculating the radiation dose to various organs and tissues as a function of time following the acute or chronic uptake of some 30 radionuclides of interest from the standpoint of possible release to the environment. (CH)

**783** (CONF-710567–, pp 100-107, PAPER 9) HANDLING AND DISPOSAL OF RADIOACTIVE MATERIALS IN HOSPITALS AND MEDICAL RESEARCH ESTABLISHMENTS. Jain, M. P. Aug 1971.

From seminar on recommendations of the international commission on radiological protection; New Delhi, India (12 May 1971).

Recommendations of the ICRP for the handling and storage of unsealed radionuclides, for monitoring of work areas and personnel, and for waste disposal are outlined. Emphasis is placed on protection against both internal and external radiation hazards during medical uses of radionuclides. Precautions to be taken for protection of those coming in contact with patients undergoing treatment with radioisotopes, both in the hospital and after discharge, are discussed and precautions during handling radioactive corpses are discussed. (CH)

**784** (CONF-730915-3) CALCULATIONS OF THE ABSORBED DOSE TO A MAN IMMERSED IN AN INFINITE CLOUD OF $^{85}$Kr. Snyder, W. S.; Dillman, L. T.; Ford, M. R.; Poston, J. W. (Oak Ridge National Lab., Tenn. (USA)). 1973. 22p. Dep. NTIS $3.25.

The dosimetry for a person exposed to a large cloud of $^{85}$Kr, supposed to be uniformly distributed in air, is considered. Methods are described that are general, and will also apply to exposure to an infinite cloud of other noble gases. Computer calculations are used for estimates of dose in an anthropomorphic phantom. The decay scheme of $^{85}$Kr which is taken from MIRD Pamphlet No. 6 is included. There is only one photon and its intensity is only 0.41% per disintegration. (auth)

**785** POSSIBLE SEQUELAE OF RADIOACTIVE IODINE ON MAN. Il'in, L. A.; Arkhangel'skaya, G. V. (Inst. of Biophysics, Moscow). Med. Radiol.; 18: No. 8, 66-80(Aug 1973). (In Russian).

A bibliographic review is given of the possible sequelae of radioactive iodine on man. (JSR)

**786** RAISED PLASMA-THYROID-STIMULATING-HORMONE LEVELS IN THYROTOXIC PATIENTS TREATED WITH IODINE-131. Toft, A. D.; Barnes, E. W.; Hunter, W. M.; Seth, J.; Irvine, W. J. (Univ. of Edinburgh). Lancet; No. 7830, 644-645(22 Sep 1973).

Sixty-nine euthyroid patients who had raised plasma-thyroid-stimulating-hormone (T.S.H.) levels (>7.4 μu per ml) in February, 1972, after $^{131}$I therapy for thyrotoxicosis between 1954 to 66 were reassessed fifteen months later. The initial mean plasma-T.S.H. level in the 66 patients who remained euthyroid (25.0 ± 2.0 μu per ml) was unchanged (22.6 ± 1.8 μu per ml) at the end of the study. Overt hypothyroidism developed in only three patients with initial plasma-T.S.H. levels of 34.6, 45.6, and 90.4 μu per ml. At follow-up, these patients had plasma-T.S.H. levels of 67.3, 28.2, and 92.8 μu per ml, respectively. It is pointed out that since raised plasma-T.S.H. concentration occurring after radioiodine treatment of thyrotoxicosis does not alter for a considerable period, it cannot be used as an indication of impending overt hypothyroidism. (auth)

**787** ENVIRONMENTAL LUNG DISEASE. FitzGerald, M. X.; Carrington, C. B.; Gaensler, E. A. (Boston Univ.). Med. Clin. N. Amer.; 57: No. 3, 593-622(May 1973).

Environmental lung diseases are reviewed with regard to classification, diagnosis, the chest roentgenogram, special diagnostic procedures, pathology, and evaluation of pulmonary impairment. Causes of environmental lung diseases are classified as follows: inorganic dusts containing free silica, silicates, carbon, and inert metals; biological dusts; toxic chemicals; microorganisms; and occupational respiratory carcinogens such as arsenic, cobalt, nickel, asbestos, and uranium. The prevalence of bronchogenic carcinoma due to radioactive uranium among miners in Czechoslovakia is discussed and it is pointed out that there is an increased prevalence of carcinoma among uranium miners in Utah and Colorado. (HLW)

**788** FUNCTIONAL CONDITION OF THE ADRENAL CORTEX IN PATIENTS SUFFERING FROM THYROTOXICOSIS AT REMOTE PERIODS AFTER CONSERVATIVE TREATMENT AND RADIOACTIVE IODINE THERAPY. Burleva, S. M. Probl. Endokrinol.; 19: No. 4, 24-28(1973). (In Russian).

A study was made of glucocorticoid and mineralocorticoid activity of the adrenal cortex in 102 paitents suffering from thyrotoxicosis in the process of conservative treatment, and radioactive iodine therapy. Conservative therapy, both with and without use of corticosteroids, improved the indices of gluco- and mineralocorticoid activity, but failed to cause their normalization, however. Radioactive iodine therapy in patients with thyrotoxicosis of moderate severity led in one year to normalization of the adrenal cortex function; as to the patients with severe thyrotoxicosis—it only improved this function. (auth)

**789** EARLY AND LATE RESULTS OF TREATMENT OF SYRINGOMYELIA WITH RADIOACTIVE IODINE. Mularek, J.; Gembicki, M. (Medical Academy, Poznan, Poland). Neurol. Neurochir. Pol.; 6: 861-864(1972). (In Polish).

Clinical analysis of early and late results of treatment of syringomyelia with $^{131}$I in 15 cases is reported. Some direct therapeutic effects were observed but they were not permanent. Follow-up observations during 5 yrs showed that one course of this treatment can not prevent further development of the disease. The authors believe that radioactive iodine may be included into the armamentarium of therapeutic methods used in syringomyelia and repeated courses of treatment are postulated. (auth)

### Animals

*Refer also to abstract 123.*

**790** (CONF-730525-, pp 203-209) PRELIMINARY EXPERIMENTAL RESULTS ON THE EFFECT OF OXYGEN-18 ON MICE. Samuel, D.; Wolf, D.; Meshorer, A.; Wasserman, I. (Weizmann Inst. of Science, Rehovot, Israel). (Argonne National Lab., Ill. (USA)). 1973.

From first international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

Proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

Toxicity tests for $^{18}$O were undertaken by supplying in one series of experiments all the water drunk by mice as $H_2{}^{18}O$ and in another series of experiments enriching both water drunk and oxygen breathed with $^{18}$O. At the same time, studies were made on the isotopic incorporation of oxygen into various organs and on the effect of high $^{18}$O-concentrations on reproductive behavior. No toxic effects were observed due to breathing and drinking $^{18}$O enriched air and water during the 60 day experimental period. Oxygen-18 concentrations were high in body water, low in bone and lungs, and high in blood and kidneys. (ERB)

**791** (CONF-730525-, pp 210-218) DEUTERIUM OXIDE ADMINISTRATION TO COTURNIX JAPONICA: BIOLOGICAL EFFECTS AND INCORPORATION OF DEUTERIUM INTO NON-ESSENTIAL AMINO ACIDS OF EGG WHITE. Torres, C. C.; Sutton, S. P.; Dam, R. (Univ. of Nebraska, Lincoln). 1973.

From first international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

Levels of 7.81, 18.46, and 26.02 mole % $D_2O$ were given successively to Japanese quail and gross biological effects were measured. The most significant effect was a decrease in egg frequency during the period of 26.02 mole % $D_2O$ administration. The maximum D concentration in the water of the egg was reached within 96 to 100 hrs after the initial administration and it was 6.90, 14.55, and 20.15 mole % respectively during the 3 periods of $D_2O$ administration. These values implied 21 to 22% of the water in the egg was water derived from metabolism, during the latter two periods, compared to 12% when the lowest level of deuterium was fed. The amino acids were isolated from the egg white proteins obtained during the 18.46 mole % $D_2O$ feeding, and analyzed for deuterium content by mass spectrometry of their respective dansyl derivatives. As an example, the results for alanine indicated a mole per cent distribution of 56 ± 1.4 unlabeled, 34.6 ± 1.1 monolabeled, 8.3 ± 0.2 doubly labeled, and 1.0 ± 0.2 triply labeled molecular species. Initial interpretation of these results implies that the quail synthesizes all of the alanine necessary for egg white protein synthesis, utilizing no dietary alanine. A final interpretation of metabolic pathways involved is dependent on knowledge of distribution of label within the molecule and degree and distribution of label in carbohydrate percursors. (auth)

**792** INFLUENCE OF INCORPORATED RADIOISOTOPES ON IMMUNOLOGIC PROCESSES. Nevstrueva, M. A.; Shubik, V. M.; Tokin, I. B. Moscow; Atomizdat (1972). 449p. (In Russian).

The effect of the ratio of radioisotopes on the immunological reactivity in the animal organisms was examined. Both the antimicrobe resistance and the formation of autoantibodies in the irradiated organism were studied. Carrying out the study under different conditions (the complete organism, cellular, and subcellular) with the use of modern methods made it possible to reveal some mechanisms of change of immunity under the effects of incorporated radioisotopes. (tr-auth)

**793** EFFECTS OF $^{90}$Sr AND $^{137}$Cs ADMINISTERED CONTINUOUSLY UPON MICE. IX. Weights of Thymus and Spleen Related to Aging of Mice. Nishio, K. Annu. Rep. Radiat. Center Osaka Prefect.; 13: 121-123(1972).

Weight change of thymus and spleen of mice administered continuously with $^{90}$Sr and $^{137}$Cs was observed in relation to reproduction-span and incidence of leukemia. $^{90}$Sr and $^{137}$Cs were administered through drinking water, and the propagation was done by brother-and-sister mating. The levels of water contamination were 0.1 $\mu$Ci of $^{90}$Sr and 0.4 $\mu$Ci of $^{137}$Cs per ml in group-1, as $^{1}/_{10}$ respectively as group-I in group-II and as $^{1}/_{100}$ respectively as group-I in group-III. Experimental mice belonged to generation from the 3rd to 9th. Control was named group-IV. Decrease of thymus weight in female mice are parallel to decrease of reproductive function (litter size per birth) in all groups. It is noticeable especially in group-III that thymus weight is on higher level than group-IV at 400 days of age in agreement with not yet disappeared reproductive function while thymus weight is lighter as well as litter size is smaller than IV at 300 days. The delay to older age in age of first and last birth as well as in atrophy of thymus in female of III would be due to breaking of aging. Decrease of spleen weight related to age is quite simple in IV, but very complicated in inner-irradiated groups. The highest induction to leukemia and the highest level of spleen weight are observed in female of I. This correlation suggests that hard compensative hypertrophy of spleen against blood or spleen cell damage might induce leukemia. (auth)

**794** FIVE-YEAR INHALATION STUDY WITH NATURAL URANIUM DIOXIDE ($UO_2$) DUST. 2. Postexposure Retention and Biologic Effects in the Monkey, Dog, and Rat. Leach, L. J.; Yuile, C. L.; Hodge, H. C.; Sylvester, G. E.; Wilson, H. B. (Rock Island Arsenal Lab., IL). Health Phys.; 25: No. 3, 239-258 (Sep 1973).

Inhalation studies show that dogs, monkeys, and rats can breathe a natural uranium dioxide aerosol of approximately 1 $\mu$m mass median particle diameter at a mean concentration of 5 mg $U/m^3$ (25 × Threshold Limit Value or 28 × Maximum Permissible Concentration in Air) for periods as long as 5 yr with little evidence of serious injury (L. J. Leach et al., Health Phys. 18: 599 (1970)). Some of these animals were observed for protracted postexposure periods during which pulmonary neoplasia developed in a high percentage of the dogs examined 2 to 6 yr after exposure. Pulmonary and tracheobronchial lymph node fibrosis, consistent with radiation effects, apparently dose dependent, and more marked in monkeys than in dogs was also noted. No evidence of uranium toxicity was found in records of body weights, mortality, various hematologic parameters, or the histologic condition of the kidneys. (auth)

**795** RADIOSTRONTIUM-INDUCED CARCINOMAS OF THE EXTERNAL EAR. Nilsson, A. (Foersvarets Forskningsanstalt, Stockholm). Acta Radiol., Ther., Phys., Biol.; 10: No. 1, 321-328 (Feb 1971).

The effect of $^{90}$Sr on the soft tissues of the external ear was studied at different intervals after an intraperitoneal injection of $^{90}Sr(NO_3)_2$ to four groups of mice. Highly differentiated squamous cell carcinomas were detected in about 20% of the mice given the highest dose of $^{90}$Sr(1.6 $\mu$Ci/g body weight). The majority of the carcinomas were found to start their development in a sebaceous gland outside the external auditory meatus. (auth)

**796** CELL POPULATION OF THE RAT SMALL INTESTINE UNDER CONDITIONS OF INTERNAL RADIATION BY CERIUM-144 AT DIFFERENT DOSES. Ponomareva, T. V.; Tokin, I. B. (Leningrad State Univ.). Biol. Nauki; No. 12, 43-49(1971). (In Russian).

The dynamics of the change of the number and properties of the cell population, mitotic activity, and number of aberrant mitoses of the epithelia of the rat small intestine under conditions of internal radiation by $^{144}$Ce were traced. Ce was introduced internally in quantities of 2, 20, and 200 $\mu$C into one rat. It was shown that the dose output fluctuates throughout the period of the investigation and reaches a maximum in the fifth day. The injury to the intestinal epithelia is also maximum during this period but its degree depends on the concentration of the internal isotope. The change in the number of aberrant mitoses clearly correlates with the change of the dose output of the isotope on the intestine. The dynamics of other indicators are characterized by a very sharp periodicity, dependence both on the change of the dose output and on other secondary factors. (tr-auth)

**797** CHANGES IN BLOOD SERUM PROTEIN FRACTIONS OF PATIENTS WITH RHEUMATOID ARTHRITIS AND SPONDYLOARTHRITIS ANKYLOPOIETICA UNDER THE INFLUENCE OF SULFIDE AND RADON-WATER BALNEOTHERAPY IN LADEK-ZDROJ. Zielonka, E.; Kolodziejczyk, A. Przegl. Lek.; 30: No. 4, 375-378(1973). (In Polish).

It was found that sulfide- and radon-containing water from the spring "Jerzy" exerts influence on the metabolism of some globulin fractions in patients with rheumatoid arthritis and spondyloarthritis ankylopoietica. A statistically significant increase in $a_1$ and $a_2$ globulins was found in 50 patients with primary rheumatoid arthritis, whereas in 20 patients with spondyloarthritis ankylopoietica only the increase in $a_1$ globulin fraction was observed. In both groups of patients, albumins and $\gamma$-globulins were not elevated. It was concluded that the increase in the two abovementioned fractions was effected by the pharmacodynamic action of radon. (auth)

### *Microorganisms*

**798** (CONF-730525-, pp 41-47) CULTURE OF THERMOPHILIC ALGAE AND OTHER MICROORGANISMS IN HEAVY WATER. Crespi, H. L.; DaBoll, H. F.; Mrtek, R. G.; Katz, J. J. 1973.

From first international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

Two species of thermophilic algae, Chlorella pyrenoidosa and Synechococcus lividus, were cultured in heavy water. Analysis of the doubling times and growth curves for the algae in heavy water indicate a consistent deuterium isotope effect on the growth rate of the algae in heavy water as compared to $H_2O$. The effect is particularly noted in light-saturated cultures. Light-limited cultures show a smaller decrease in growth rate and may be useful in deriving fully deuterated products. (ERB)

## Nuclide Kinetics and Toxicology

*Refer also to abstracts 402 and 2389.*

**799** ATOMIC ENERGY AND ENVIRONMENTAL SITUATION. Radiointoxication of the Biosphere. Weish, P.; Gruber, E. Frankfurt am Main; Kramer (1973). 71p. (In German).

A survey on radiointoxication of the biosphere by nucleonics is presented. Ionizing environmental radiation induces part of the spontaneous mutations and so forms an important condition of the evolution of organisms. The number of radioinduced mutations is proportional to the dose; the mutagenic effects of but very small doses being accumulated over long periods. Because of reduced natural selection in civilization there is an increase in spontaneous mutation rate and therefore in genetic damage and diseases with genetic components (e.g. carcinoma, leukemia). For genetic effects as well as for cancerogenesis, no harmless dose can be defined. In the biosphere, accumulation and distribution of radioactive substances by plants and animals along with the radiation effects caused by the incorporated radionuclids in the organisms are significant. The contamination of waters by fission products already causes local developmental disturbances in the hatch of fish. All domains of nucleonics, reaching from uranium ore mining to waste disposal, take part in the increase of radiointoxication of the biosphere (e.g. radioactive emission during normal operation, possible accidents). (GE)

## Man

*Refer also to abstracts 407–409, 626, 696, 878, 879–881, and 900.*

**800** (CONF-710567–, pp 30–42, PAPER 4) STANDARD MAN: LUNG AND GI TRACT MODELS. Jain, S. C. Aug 1971.

From seminar on recommendations of the international commission on radiological protection; New Delhi, India (12 May 1971).

The Standard man evolved by the ICRP to represent a typical (or average) adult for use in internal radiation dose estimations is described and parameters used are presented. Models for upper and lower respiratory tract intake, retention, and clearance of particulates, developed in 1964, and a four-compartment model of the gastrointestinal tract, developed in 1959, are also described. It is pointed out that the parameters of the Standard man should be adjusted in relation to values for the average adult in various geographical areas. (CH)

**801** METHOD OF DETERMINATION OF CORRECTION FACTORS FOR DIFFERENT BODY BUILDS IN THE ASSESSMENT OF $^{239}$Pu IN THE LUNG. Shirotani, T.; Fujita, M. (Japan Atomic Energy Research Inst., Tokai). J. Nucl. Sci. Technol. (Tokyo); 10: No. 5, 301-308(May 1973).

In the determination of $^{239}$Pu deposited in the lungs of exposed subjects by external "in vivo" counting, some corrections must be made for the calibration factor obtained from a phantom, to take account of differences in body size between the phantom and the exposed subjects. Three such correction factors were considered in this work, and determined experimentally: (1) the geometrical efficiency of the exposed subject was estimated using lung-shaped plane sources of actual size; (2) the shielding effect of the sternum and ribs viewed by the NaI(Tl)-detector of large area was measured from chest x-ray plates of the fifteen subjects; and (3) the effective chest wall thickness was evaluated by means of an empirical formula. Estimations of $^{239}$Pu in the lungs are expected to contain errors up to about 24.8%, due to the uncertainities in these correction factors. (auth)

**802** DETERMINATION OF THE STRONTIUM-90 ACTIVITY IN HUMAN BONES. Mendonca, A. H.; Franca, E. P. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). An. Acad. Brasil. Cienc.; 43: No. 3–4, 813-820(1971). (In Portuguese).

In 1968, UNSCEAR recommended that a survey on the contamination of biological materials such as human bone was encouraged on areas where only fragmentary information was available. In Brazil, samples were collected from individuals who died in Rio de Janeiro from accidents. These samples were first classed according to social level in very poor and poor groups. Results showed that levels fround in the Brazilian age groups were close to the ones observed in Chile (1969), Argentina, and Australia (1966–1968) and slightly higher than those observed in Venezuela, Senegal, and Jamaica (1969). The results obtained from the North and South hemispheres respectively were compared. It was noticed a more pronounced decrease in the levels of $^{90}$Sr in bones from populations of the North hemisphere, indicating that recent atmospheric tests undertaken by French in the Pacific, contributed in a slight way to increase the $^{90}$Sr content of the diet of some regions of South America. (INIS)

**803** SCANNING BED TECHNIQUE OF WHOLE-BODY COUNTING FOR THE MEASUREMENT OF WHOLE-BODY OF GAMMA EMITTING NUCLIDES. Part 2. The Evaluation of the Usability of the Arrangement for In Vivo Measurements. Karniewics, W. (Instytut Madycyny Pracy w Przemysle Wlokienniczym i Chemicznym, Lodz, Poland). Postepy Fiz. Med.; 7: 9-23(1972). (In Polish).

Evaluation of the geometrical conditions established for determination of the whole-body retention of radioactive tracers administered to a human body was investigated. The nuclides differed in the emitted energy of gamma radiation from 0.12, to 1.29 MeV and in the distribution in the surveyed organisms. The determination of the whole-body retention following oral or intravenous administration of $^{57}$Co or $^{58}$Co marked vitamin B$_{12}$, $^{59}$Fe marked iron, and $^{85}$Sr was based on: the quantity of the isctope expelled in urine and excrement, and the whole-body counting employing the scanning bed technique. The correspondence of the results obtained by these two methods was analyzed. (auth)

**804** HUMAN EXPOSURE TO NATURAL URANIUM. A Case History and Analytical Results From Some Postmortem Tissues. Donoghue, J. K.; Dyson, E. D.; Hislop, J. S.; Leach, A. M.; Spoor, N. L. (Atomic Energy Research Establishment, Harwell, Eng.). Brit. J. Ind. Med.; 29: No. 1, 81-89(1972).

After the collapse and sudden death of an employee who had worked for 10 years in a natural uranium workshop, in which the airborne uranium was largely $U_3O_8$ with an Activity Median Aerodynamic Diameter in the range 3.5 to 6.0 μm and average concentration of 300 μg/m$^3$, his internal organs were analyzed for uranium. The tissues examined included lungs (1041 g), pulmonary lymph nodes (12 g), sternum (114 g), and kidneys (217 g). Uranium was estimated by neutron activation analysis, using irradiated tissue ash, and counting the delayed neutrons from $^{235}$U. The concentrations of uranium (μg U/g wet tissue) in the lungs, lumph nodes, sternum, and kidneys were 1.2, 1.8, 0.09, and 0.14 respectively. The weights deposited in the lungs and lumph nodes are less than 1% of the amounts calculated from the environmental data using the parameters currently applied in radiological protection. The figures are compatible with those previously reported by Quigley, Heatherton, and Ziegler (USAEC Report HASL-58 p34-40 (1958)) and by Meichen (Atompraxis; 8: 24-6 (1962)). The relation between these results, the environmental exposure data, and biological monitoring data is discussed in the context of current views on the metabolism of inhaled insoluble uranium. (auth)

**805** FALL-OUT CESIUM-137 IN BREAST- AND BOTTLE-FED INFANTS. Rundo, J. pp 60-62 of Chemical and Radionuclide Food Contamination. New York; MSS Information Corp. (1973).

Data on the content of fallout $^{137}$CS in nursing mothers and in infants in relation to the intake of mother's milk or cow's milk (fresh, dried, or evaporated) are presented. The $^{137}$Cs content in breast-fed babies never exceeded that of the mother, but the reverse was true in bottle-fed babies. (CH)

**806** PROTECTIVE ACTIONS FOR RADIOIODINE IN MILK. Bernhardt, D. E.; Carter, M. W.; Buck, F. N. pp 108-124 of Chemical and Radionuclide Food Contamination. New York; MSS Information Corp. (1973).

Protective actions are defined as control measures that can be taken to reduce the exposure of individuals or population groups to radiation that would occur from future ingestion of foods contaminated with radioactive materials. Results from investigations of protective action for radioiodine in milk indicate that substitution of uncontaminated feed for contaminated feed for the affected cows reduced the potential human thyroid dose from $^{131}$I about 70%. This action, taken three days after the deposition of radioactivity, also reduced the exposure from $^{133}$I about 10%. Earlier protective action would have increased the reduction in exposure, especially for the $^{133}$I, but would have, of necessity, been based on less reliable data. To insure timely action, it is necessary to have data from a suitable monitoring system, a predictive capability for using this data, operational procedures for initiating prompt action, and appropriate public health guidelines and authority. (CH)

**807** PREDICTIONS OF $^{90}$Sr LEVELS IN MILK ON THE BASIS OF DEPOSITION VALUES. van der Stricht, E.; Gaglione, P.; De Bortoli, M. pp 125-134 of Chemical and Radionuclide Food Contamination. New York; MSS Information Corp. (1973).

Mathematical models for the prediction of fallout $^{137}$Cs and $^{90}$Sr levels in milk were evaluated on the basis of measurements of fallout deposition on forage grass, content of soil samples, content of atmospheric precipitation, and farming practices, made between 1961 and 1968. Good correlation was found between measured and predicted values. (CH)

**808** PREDICTION MODELS FOR $^{90}$Sr IN SHED DECIDUOUS TEETH AND INFANT BONE. Aarkrog, A. pp 135-141 of Chemical and Radionuclide Food Contamination. New York; MSS Information Corp. (1973).

The agreement between predicted and observed human tooth and bone levels supports the theory that the pCi $^{90}$Sr/g Ca ratio in deciduous tooth crowns equals the bone level of 1-yr old infants and vice versa. The agreement furthermore indicates that the earlier estimated fallout levels for the period 1950 to 1961 were not far off the actual fallout situation in Denmark and the Faroes in this period. Furthermore the use of an infant diet model consisting of 75% milk and 25% adult diet for the calculation of the tooth and bone levels on the basis of an observed ratio between bone tissue and diet of 0.25 has been shown to be justified. (auth)

**809** DETERMINATION OF AN ACCEPTABLE $^{131}$I CONCENTRATION IN AIR WHEN THE CRITICAL INTAKE IS THROUGH MILK. Van As, D.; Vleggaar, C. M. pp 142-144 of Chemical and Radionuclide Food Contamination. New York; MSS Information Corp. (1973).

Variations in the content of fallout $^{131}$I in milk in relation to the content in air were demonstrated to be dependent on atmospheric precipitation. Increases in the $^{131}$I content of milk from grazing cattle were observed almost immediately following periods of precipitation. Data on the content of $^{131}$I in air and milk during a three-month period were analyzed in relation to dry deposition or washout. It is suggested that values to compensate for dry deposition and washout be used in calculating the maximum permissible concentration of $^{131}$I in air for the general public when the critical food chain is forage-cow-milk-man. (CH)

**810** RADIOLOGIC STUDY OF INORGANIC URINARY CALCULI. I. Comparison of Stable and Radioactive Strontium Deposition in Urinary Calculi and Human Bones. Herring L. C.; Keefer, D. H. pp 145-156 of Chemical and Radionuclide Food Contamination. New York; MSS Information Corp. (1973).

Data are presented on the content of $^{90}$Sr, stable Sr, and Ca in some 50,000 inorganic urinary calculi from human patients collected throughout the USA during 1961 to 1966. The samples were grouped according to age and geographical location of the patients. The data were compared with that of bone samples collected during the same period of time. The results of radiometric analysis of samples of both bone and calculi showed the retention of low levels of fallout $^{90}$Sr, with concentrations well below the radiation protection guides of the Federal Radiation Council. The close correlation between the content of $^{90}$Sr in bone samples and urinary calculi suggests that analysis of urinary calculi could be used as a monitoring method for $^{90}$Sr in human bones. (CH)

**811** COMPARISON OF STABLE AND RADIOACTIVE STRONTIUM DEPOSITION IN URINARY CALCULI AND HUMAN DIET. Herring, L. C.; Keefer, D. H. pp 157-164 of Chemical and Radionuclide Food Contamination. New York; MSS Information Corp. (1973).

A comparison was made between the $^{90}$Sr and stable Sr content of the human diet and the content of urinary calculi from urolithiasis patients collected from throughout the USA during the five-year period from 1961 to 1966. Data on the $^{90}$Sr content of selected foods representing 19 food categories in the average diet in Chicago, New York City, and San Francisco and data from US Department of Agriculture household food surveys were used to estimate the $^{90}$Sr content in the average diet and in that of teenagers. Data are included on the content of Ca and stable Sr in the diet and on the relation of milk consumption to $^{90}$Sr uptake. The results showed that the urolithiasis patients, most of whom were in the older age groups, were consuming approximately three times the concentrations of $^{90}$Sr and stable Sr found to be present in their urinary calculi. (CH)

**812** SCANNING BED TECHNIQUE OF WHOLE-BODY COUNTING FOR THE MEASUREMENT OF WHOLE-BODY RETENTION OF GAMMA EMITTING NUCLIDES. Part I. The Choice of Optimal Geometry. Karniewicz, W.; Surma, M. (Instytut Medycyny Pracy w Przemsle Wlokienniczym i Chemicznym, Lodz, Poland). Postepy Fiz. Med.; 7: 1-8(1972).

The whole-body retention of gamma-emitting isotopes was determined in vivo using scanning bed technique and the geometry analysis was made to select the optimal conditions. The method of Ben Heim and Dudley was employed for the model experiment. The smallest dependence of the counting efficiency on the distribution of the tracer in the investigated organism was observed when a) the distance between the detector and the subject equalled 45 cm and b) the counting efficiency was expressed as a geometric mean of the results obtained from the measurements of the human subjects in two positions: prone and supine. (auth)

**813** LUNG CANCER RISK BY INHALATION OF $^{222}$Rn-DECAY PRODUCTS. Jacobi, W. (Gesellschaft fuer Strahlen und Umweltforschung mbH, Munich). Biophysik; 10: No. 2, 103-114(1973). (In German).

The results of surveys in the USA and the CSSR about the lung cancer mortality among uranium miners are compared. The relation between the observed excess lung cancer mortality and the cumulative exposure of these miners by inhaled Rn-daughters is discussed and the risk coefficients for radiation-induced lung cancer are estimated. The relative risk coefficients of both study groups of U miners agree within the confidence limits and are in the range of 0,001 to 0,005 $\mathrm{WLM}^{-1}$. The derived absolute risk coefficients of 20 ± 10 (USA group) and 150 ± 50 (CSSR group) additional lung cancer deaths per WLM and $10^6$ miners are, however, significantly different. The influence of synergistic or cocancerogenic actions is discussed. The increase of lung cancer mortality with Rn-exposure is significantly correlated with an increase of the small-cell, undifferentiated type of carcinoma. (auth)

## Animals

*Refer also to abstracts 123, 790, and 791.*

**814** (LF-tr-80) CANCERS PROVOKED IN THE BABOON MONKEY (PAPIO PAPIO) BY THE INHALATION OF $PuO_2$. Metivier, H.; Nolibe, D.; Masse, R.; LaFuma, J. Translated by A. A. Horvath (Lovelace Foundation for Medical Education and Research, Albuquerque, NM), from Compt. Rend., Ser. D; 275: No. 25, 3069-3072(1972). 6p. Dep. NTIS $3.00.

Young baboon monkeys developed lung cancers after inhalation of $^{239}$Pu oxide, which appeared earlier than in the dog, the rat or the mouse. The observed tumors, epidermoidal carcinomas and adenocarcinomas, were very similar to those observed in man. Thus, results from this animal can be considered as an excellent intermediary for the extrapolation to humans of results observed in small species. A table is presented to show survival times, radioactivity in μCi/gm of fresh tissue at the time of death, and types of neoplasms observed. (HLW)

**815** MULTIVARIATE ANALYSIS OF Ca-DTPA-EFFECTIVENESS IN REMOVING $^{241}$Am FROM THE RAT. Seidel, A. (Kernforschungszentrum, Karlsruhe, Ger.). Z. Naturforsch.; 28C: No. 5-6, 316-318(1973).

Female albino rats of the Heiligenberg-strain were i.v. injected with $^{241}$Am-citrate and received a single i.p. injection of $Na_3$[Ca-DTPA] at different times after the $^{241}$Am injection. The dependence on time of the dose-effect relationship was studied for the removal of $^{241}$Am from the skeleton and the liver. Due to the linearity of the dose-effect-curves (in a log-log scale) as well as to the linear dependence of the slope on the logarithm of time, simple equations were derived which describe the mobilization of $^{241}$Am as influenced by DTPA-dosage and time of treatment. (GE)

**816** METABOLISM OF THORIUM RADIONUCLIDES IN THE BODY OF RATS AFTER INTRATRACHEAL INTRODUCTION OF SOLUBLE THORIUM COMPOUND ($ThCl_4$). Makeeva, L. G.; Pavlovskaya, N. A. (Inst. of Hygiene and Preventive Medicine, Erevan). Gig. Sanit.; No. 8, 45-47(Aug 1973). (In Russian).

Data are presented on the rate of resorption in the blood of $^{228}$Th and the products of its dissociation. The finding was that after intratracheal introduction into the body of thorium chloride a significant disturbance of radioactive balance was noted to take place in the lungs and other internal organs. (auth)

**817** FORMS OF $^{99}$Mo PRESENT IN THE ANIMAL BODY. Shvydko, N. S.; Il'in, L. A.; Popov, D. K. (Leningrad Scientific Research Inst. of Radiation Hygiene). Gig. Sanit.; No. 8, 51-54 (Aug 1973). (In Russian).

$^{99}$Mo metabolism was investigated in the complex study of the connection existing between the isotope and the separate components of the blood, liver, and the bone tissue. The levels of $^{99}$Mo cumulation and the rate of its removal from the liver, kidneys, and skeleton were determined. Quantitative distribution of $^{99}$Mo in separate fractions of the analyzed organs and the peculiar traits in the mechanism of the isotope connection with the liver proteins were demonstrated. (auth)

**818** STUDY OF THE EXPERIMENTAL CONTAMINATION OF MARINE INVERTEBRATES WITH $^{137}$Ce AS A FUNCTION OF THEIR SIZE. Triquet, C. (Univ., Nantes, France). Compt. Rend. Soc. Biol.; 166: No. 10, 1311-1313(1972). (In French).

Various mollusca were studied. Contamination of the shells is due to a physical or physicochemical adsorption process to which the animal is passively subjected. In contrast, the contamination of the flesh is due to a metabolism phenomenon that is more effective with young mollusca i.e., those of small size. The variations in the volume/surface ratio can also intervene in the differences observed between small and large individuals. (FR)

**819** EXPERIMENTS WITH LAYING HENS TO REDUCE THE RETENTION OF $^{85}$Sr. Nezel, K. (Bundesforschungsanstalt fuer Kleintierzucht, Celle, Ger.). Arch. Gefluegelk.; 37: No. 3, 97-101 (1973). (In German).

The addition of alginate to the food at the same time as $^{85}$Sr reduces the retention of the radionuclide in bones, muscles, and eggs. One percent in the food shows no effect. On the other hand 2.5% lower the retention by about as much as 5%. Additional $CaSO_4$ increases the effect. The origin of the product seems to be important for the retention-reducing-activity. (auth)

**820** EXPERIMENTAL STUDIES ON METABOLISM IN HARD STRUCTURES OF THE TEETH. I. Metabolism of $^{95}$Nb in Soft and Hard Tissues; Investigations in Syrian Golden Hamster. Held, M.; Finck, W.; Radtke, G.; Rother, U.; Unterspann, S. (Univ. Klinik und Poliklinik fuer Stomatologie, Rostock, Ger.). Deut. Stomatol.; 23: No. 2, 81-86(Feb 1973). (In German).

Animal experiments with niobium (in the form of the radioactive isotope niobium-95) permitted its rate of deposition and its kinetics in various organs (blood, liver, spleen, kidneys, bones, and teeth) to be determined. As a result of these experiments it is stated that all organs under investigation absorb niobium at nearly the same rate for the first 24 hrs. In contrast with soft tissues, teeth and bones released no niobium during a period of 500 hrs. Fixation to the hard structures of the teeth is considered to be the cause of this. (auth)

**821** ELIMINATION OF $^{90}$Sr FROM THE BODIES OF COWS. Dauskurdis, S. I. (Veterinary Lab., Tbilisi, USSR). Veterinariya; 48: 32-34(Mar 1972). (In Russian).

In experiments with lactating cows fed on silage, the amount of $^{90}$Sr excreted in the milk was 15% less than in the controls, which were fed a diet of silage plus hay, although the experimental diet had a higher $^{90}$Sr concentration. The total $^{90}$Sr excreted daily in milk, urine, and feces was 94 to 98% of that in the feed in the experimental animals and 91 to 98% in the controls. The bones, after slaughter, of the experimental animals contained 3% less $^{90}$Sr than the controls. The absorption of feed $^{90}$Sr in the gastrointestinal tract (1.6 to 5.6% of the daily dose in the experimental group and 1.4 to 9.2% in the controls) may be compared with some literature data indicating that 8 to 10% of the $^{90}$Sr in the feed is absorbed. (TTT)

**822** EXPERIMENTAL STUDY OF THE FIXING AND ELIMINATING OF $^{65}$Zn BY MYTILUS GALLOPROVINCIALIS (Lmk). Baudin, J. P. (CEN de Cadarache, Saint-Paul-les-Durance, France). Compt. Rend., Ser. C; 277: No. 1, 113-116(2 Jul 1973). (In French).

Mussels from Lake Citis (brackish lake situated west of lake Berre) were retained for 84 days in $^{65}$Zn labeled water. After this period 29% of the radioelement introduced was found to be fixed in the soft parts. In a second part of the experiment, the mussels having fixed $^{65}$Zn were then placed in inactive water: a slow elimination of the radioactive Zn was observed. Two biological half-lives are connected with the disappearance of the Zn: a short half-life of 4 days and a much longer half-life of 214 days. (FR)

**823** HELIOTHIS VIRESCENS: ASSIMILATION AND RETENTION OF RADIOACTIVITY IN EGGS AND LARVAE FROM $^{32}$P-TREATED ADULTS. Hines, B. M. (Mississippi State Univ., State College); Harris, F. A.; Mitlin, N. J. Econ. Entomol.; 66: No. 5, 1071-1073(15 Oct 1973).

Female moths of Heliothis virescens (F.) were fed $^{32}$P (in $NaH_2{}^{32}PO_4$) in a 10% sucrose solution. Incorporation of $^{32}$P was determined in eggs laid on days 3 to 14 after treatment of 2- to 3-day-old moths. Larvae from radioactive eggs retained the $^{32}$P in measurable amounts throughout their development until pupation. Radioactivity levels in the larvae declined at a relatively constant rate during the larval development period. H. virescens eggs and larvae assimilate and retain high levels of radioactivity from $^{32}$P-treated female parent moths. Mean CPM (counts per minute) egg ranged from 2162 to 3191 during a 3- to 14-day period of oviposition after treatment of the moths, and mean CPM/larva ranged from 1045 to 3137 for a similar period of 3 to 16 days after hatching from radioactive eggs. (auth)

**824** EFFECTS OF INHALED $^{144}CeO_2$ ON INFLUENZA VIRUS INFECTION IN MICE. Lundgren, D. L.; Sanchez, A.; Thomas, R. L.; Chiffelle, T. L.; McClellan, R. O. (Inhalation Toxicology Research Inst., Albuquerque, NM). Proc. Soc. Exp. Biol. Med.; 144: No. 1, 238-244(Oct 1973).

The effects of chronic beta-radiation from inhaled $^{144}CeO_2$ that resulted in beta-radiation doses of 16,000 to 19,000 rads to the lung during 8- to 20-wk intervals had little or no effect on the influenza virus concentration or hemagglutinin titers in the lungs of virus inoculated mice when compared with virus inoculated control mice. There was, however, a slight effect in suppressing hemagglutination inhibiting antibody formation. Lung weights, lung lesions and mortality of mice inoculated with influenza virus at 8, 12 and 20 wk after inhaling $^{144}CeO_2$ were reported. Increased mortality occurred at 8 wk, increases in all three parameters at 12 wk and increases in lung weights and lung lesions were observed at 20 wk. Mice that inhaled $^{144}CeO_2$ and were inoculated with virus had significant histopathological changes. These were most marked in the mice infected with virus at 20 wk postexposure in which squamous cell differentiation was a prominent finding progressing in one case to a superficial resemblance to epidermoid carcinoma. (auth)

**825** INFLUENCE OF CALCITONINS ON THE DISAPPEARANCE OF RADIOCALCIUM AND RADIOPHOSPHORUS FROM PLASMA. Talmage, R. V.; Anderson, J. J. B.; Cooper, C. W. (Univ. of North Carolina, Chapel Hill). Endocrinology; 90: No. 5, 1185-1191(May 1973).

The early temporal (0 to 2 hr) effects of porcine thyrocalcitonin and salmon ultimobranchial calcitonin were studied in intact rats administered both $^{45}$Ca and $^{32}$P either 2 weeks before (long-range label) or 5 min after (short-range label) sc injection of hormone. Effects of calcitonins on plasma calcium, $^{45}$Ca and sa were similar to those reported previously by numerous workers and thereby could be explained by the concept that these hormones act primarily by inhibiting entry of calcium into the plasma. A minor increase in the rate of calcium exit from plasma has been reported previously, and was also observed in the present study. Effects of calcitonins on $^{32}$P were in marked contrast to those on $^{45}$Ca. By 20 min after hormone administration, concentrations of both phosphate and $^{32}$P in plasma were significantly lower than in control animals and by 1 hr, reached levels 25% less than those in controls. The same results occurred in both short- and long-range experiments. Since both plasma phosphate and $^{32}$P fell correspondingly after hormone treatment, the plasma $^{32}$P sa remained unaltered after hormone administration. The data show that the calcitonins rapidly cause an increased movement of phosphate out of the plasma. These experiments raise the question as to whether calcitonin acts separately on these two ions, or whether its effect on one produces a subsequent effect on the other. (auth)

**826** RAPID FIELD-MONITORING OF CESIUM-137 IN WHITE-TAILED DEER. Rabon, E. W.; Johnson, J. E. (Du Ponte de Nemours (E. I.) and Co., Aiken, SC). Health Phys.; 25: No. 5, 515-516(Nov 1973).

A procedure for the rapid field monitoring of $^{137}$Cs in white-tailed deer is described that is used in the area surrounding the Atomic Energy Commission's Savannah River Plant. A portable, single-channel scintillation counter powered by a rechargeable battery and connected to a 2 × 2 in. NaI(Tl) crystal is used. The crystal is housed in a 9 in. diameter bell-shaped probe shielded by $\frac{1}{4}$ in. of lead. Accuracy of the $^{137}$Cs field monitoring procedure described is adequate to permit rapid release of deer killed in public hunts. Sampling frequency and subsequent laboratory analyses are now limited to animals whose indicated body burden exceeds 25 pCi/g of flesh. Statistical data obtained by the field monitoring program have allowed the deer herd to serve as an additional indicator of the effects of the Savannah River Plant on local ecology. (UK)

**827** METABOLISM OF RADIONUCLIDES. Pentreath, R. J. (Ministry of Agriculture, Fisheries and Food, Lowestoft, Eng.). pp 97-126 of Marine Radioecology. Paris; Organization for Economic Co-operation and Development (1972).

From marine radioecology symposium; Hamburg, F. R. Germany (20 Sep 1971). See CONF-710988-.

Some studies on the effects of physical parameters on the metabolism of radionuclides by marine organisms are summarized. The radionuclides discussed include $^{65}$Zn, $^{137}$Cs, $^{134}$Cs, $^{54}$Mn, $^{58}$Co, $^{59}$Fe, and $^{239}$Pu. Among the physical parameters investigated are temperature, salinity, body size, and growth rate. The physico-chemical form of the radionuclide is also important. Concentration factors are calculated for a variety of radionuclides in several marine organisms as influenced by variations in various physical parameters. (ERB)

**828** $^{210}$Po METABOLISM IN RUMINANTS. McInroy, J. F. Fort Collins, CO; Colorado State Univ. (1973). 198p. University Microfilms Order No. 73-19,888.

Thesis (Ph. D.).

The retention, secretion, and excretion of acute doses of orally administered $^{210}PoO_2$ in two ruminant species, the cow and goat, were studied. Ingestion experiments with $^{210}$Po secreted in milk were made with rats to determine if changes in chemical form had occurred that might enhance the absorption of the $^{210}$Po across the gastrointestinal tract. The major route of elimination in both species was found to be via the feces. However, a small but significant transfer of $^{210}$Po into the milk was observed. The milk secretion could be described by a three component exponential model. A transfer coefficient (percent of daily intake secreted per liter per day) of 0.012 for the cows and 0.45 for the goats was observed. Calculation of the maximum allowable contamination on pasture surfaces used for grazing the cows and goats that would result in a maximum permissible body burden to the public drinking contaminated milk indicate that 0.49 $\mu Ci/m^2$ on pastures grazing goats would result in such a body burden. Blood retention of the $^{210}Po$ indicated that red blood cells act as a long term reservoir, reaching peak concentrations within five days post-ingestion. Excretion in the urine reached a maximum within 24 hours and could be described by a three component exponential model in both species. A urine to fecal $^{210}Po$ concentration ratio ranging from 0.01 to 0.40 was observed. Polonium-210 secreted in milk from a goat given 200 $\mu Ci$ of $^{210}PoO_2$ orally was fed ad libitum to a group of rats for a period of 8 days. The tissue retention in the liver, spleen, kidney, heart and blood at the end of this time was compared to the same tissues of rats fed $^{210}PoO_2$ in neutral water solution. The concentration of $^{210}Po$ in all tissues of the milk fed rats averaged 20 times the concentration of $^{210}Po$ in the same tissues of the oxide and chloride fed rats except the liver, which averaged four times. The calculated fraction of $^{210}Po$ transferred from the gastrointestinal tract to the blood was 0.50 for the milk fed rats and 0.03 for the oxide and chloride fed rats. This was compared to the ICRP of 0.06 as the fraction transferred in their determination of maximum permissible concentrations of $^{210}Po$ in food and water. (Diss. Abstr.)

**829** AUTORADIOGRAPHIC STUDIES ON THE CELLULAR DISTRIBUTION OF CESIUM-134 IN THE SKELETAL MUSCLE OF MICE. Szentkuti, L.; Giese, W. (Tieraerztliche Hochschule, Hanover). Histochemie; 34: No. 3, 211-216(1973). (In German).

The cellular distribution of $^{134}Cs$ in the skeletal muscle of mice was investigated by histoautoradiography. A relatively high accumulation of $^{134}Cs$ was found at the sarcolemma 4 to 6 hrs after intraperitoneal application of $^{134}CsCl$. From this it can be concluded that Cs ions are probably adsorbed by the sarcolemma before they are moved into the muscle cell. Within the cell, $^{134}Cs$ seems to be linked with myofibrils at distinct distances similar to those between isotropic and anisotropic bands. (GE)

**830** NASAL ABSORPTION OF $CsCl_2$, $BaCl_2$, AND $CeCl_3$ IN SYRIAN HAMSTERS. Cuddihy, R. G.; Ozog, J. A. (Lovelace Foundation for Medical Education and Research, Albuquerque, NM). Health Phys.; 25: No. 3, 219-224(Sep 1973).

Absorption of CsCl, $SrCl_2$, $BaCl_2$, and $CeCl_3$ deposited on nasal membranes directly into the general circulation was studied in Syrian hamsters and compared with gastrointestinal tract absorption. More than 50% of the cesium, strontium, and barium was absorbed directly from the nasal membranes but less than 4% of the cerium. For all isotopes, nasal absorption was approximately equal to or greater than gastrointestinal absorption during the first 4 hr after administration. This study emphasized the importance of direct nasal absorption of deposited materials in inhalation toxicity evaluations especially with readily soluble aerosols having mass median aerodynamic diameters greater than 5 $\mu m$ when nasopharyngeal deposition predominates. (auth)

**831** DOSE DISTRIBUTION IN HEALTHY LYMPH NODES AND IN LYMPH NODES AFFECTED BY METASTASES AFTER ENDOLYMPHATIC THERAPY WITH RADIONUCLIDES. II. Investigation on Rabbits with Phosphorous-32-tri-n-octyl Phosphate and Iodine-125 Triolein in Lipiodol UF. Magnus, L. (Univ. Bochum, Essen). Strahlentherapie; 145: No. 6, 631-643 (1973). (In German).

An endolymphatic therapy with radioisotopes is performed on rabbits with phosphorus-32-labeled-tri-N-octyl-phosphate in Lipiodol and with iodine-125-labeled-triolein in Lipiodol. This therapy is applied equally to 9 healthy animals and to 19 animals with metastases in the lymph nodes. The $VX_2$-tumor on rabbits was chosen as the experimental tumor. The evaluation was performed histologically and by film dosimetry. In normal lymph nodes the preradiation after endolymphatic therapy is relatively equal. In metastatically alterated lymph nodes the dose preradiation after endolymphatic therapy is relatively equal. In metastatically alterated lymph nodes the dose distribution is much less favorable. By iodine-125 therapy a significantly better perradiation of metastatically altered lymph nodes can be obtained than with phosphorus-32 therapy. If the metastases are larger the activity uptake in the lymph nodes is so irregular that the endolymphatic therapy is not successful. Only micrometastases seem to be accessible to endolymphatic therapy. The size of metastases is limited by their demonstrability in the lymphogramm. Metastases which can be visualized in the lymphogram should be additionally treated by surgical or radiotherapeutic measures, if curative therapy is intended. (GE)

**832** USE OF SIMULTANEOUSLY ADMINISTERED $^{47}Ca$ AND $^{45}Ca$ IN THE STUDY OF CALCIUM KINETICS IN THE RAT. Le Roith, D.; Pimstone, B. (Univ. of Cape Town). Horm. Metab. Res.; 5: 118-123(Mar 1973).

A technique for measuring calcium kinetics in young rats is described, based on the two compartmental kinetic model of Heaney et al. It involves the simultaneous injection of $^{47}Ca$ and $^{45}Ca$ and the serial measurement of whole-body retention and serum specific activity of the two isotopes respectively over 36 hrs. The results in two groups of normal rats weighing 80 and 150 gm appear to validate the method as the values obtained for pool size and accretion rate in the two groups studied and the reduction of these parameters in the larger rats correspond closely to those shown by other workers using more conventional techniques. This method is designed to overcome some of the practical problems of estimating calcium kinetics in the growing rat by avoiding the need for excreta collection and sacrifice of the animal by using $^{47}Ca$ retention, and by enhancing the counting efficiency for measuring serum specific activity by the simultaneous use of $^{45}Ca$. (auth)

**833** EXPERIMENTAL INVESTIGATIONS ON EXCRETION OF CALCIUM WITH SALIVA USING A SOLUTION OF $^{45}CaCl_2$. Czerniawska, A.; Olenski, J. (Medical Academy, Bialystok, Poland). Czas. Stomatol.; 25: 355-360(1972). (In Polish).

Results of determinations of radioactivity in the saliva and plasma after intraperitoneal and intracardiac administration of an aqueous solution of $^{45}CaCl_2$ to 20 guinea pigs are described. The investigations show that periods of increased excretion of radioactive calcium with saliva occur and are dependent on the actual radioactivity in the plasma of these animals. (auth)

## *Plants*

*Refer also to abstract 377.*

**834** RADIOACTIVE FISSION PRODUCT $^{137}Cs$ IN MUSHROOMS IN W. GERMANY DURING 1963–1970. Grueter, H. pp 63-67 of Chemical and Radionuclide Food Contamination. New York; MSS Information Corp. (1973).

Measurements of the content of fallout $^{137}Cs$ in mushrooms collected from the same locations in West Germany during 1963 to 1970 showed a consistently high specific activity, being about 100 times higher than that of beef and milk. It is pointed out that boiling in a small amount of water reduced the amount of $^{137}Cs$ in mushrooms by some 50 to 66%. However, the inclusion of mushrooms in the diet contributed same 27% of the maximum annual radiation dose to man caused by incorporated $^{137}Cs$. (CH)

**835** FALLOUT $^{90}Sr$ IN BEER. Shiraishi, Y.; Ichikawa, R. pp 68-72 of Chemical and Radionuclide Food Contamination. New York; MSS Information Corp. (1973).

Data are presented on the $^{90}Sr$ content in beer produced in various locations in Japan during 1959 through 1969. The concentration of $^{90}Sr$ in beer increased following the peak in fallout deposition in 1963 and reached about 7.8 pCi/l in 1965, after which it decreased rapidly. Data are included on the content of Ca and $^{90}Sr$ in hops, malt, and spent residues of beer. (CH)

**836** FALLOUT CESIUM-137 IN BEER. Shiraishi, Y.; Ichikawa, R. pp 73-76 of Chemical and Radionuclide Food Contamination. New York; MSS Information Corp. (1973).

Data are presented on the $^{137}Cs$ content in beer produced in Japan during 1959 through 1969. The peak in $^{137}Cs$ content in beer was reached during 1964, following the peak in fallout deposition during 1963, followed by a rapid decrease. Data are included on the content of K and $^{137}Cs$ in hops, malt, and spent residues of beer. (CH)

**837** INTERCEPTION AND RETENTION OF A SIMULATED FALLOUT BY AGRICULTURAL PLANTS. Witherspoon, J. P.; Taylor, F. G. Jr. pp 165-172 of Chemical and Radionuclide Food Contamination. New York; MSS Information Corp. (1973).

Initial retention and rate of loss of fallout particles by agricultural plants were studied in relation to particle size, foliage characteristics, wind speed, and precipitation. Particles of $^{86}Rb$ fallout simulant of 44 to 88 $\mu$ and 85 to 175 $\mu$ diameter were applied to six-weeks-old plants of squash (Cucurbita moschata), soybeans (Glycine max), grain sorghum (Sorghum vulgare), peanuts (Arachis hypogaea), and clover (Lespedeza stipulacea) planted in field plots and maintained according to standard agricultural practice. Plant samples were taken the day before application of fallout simulant for determinations of foliage area and weight per soil area. Samples were taken at intervals of 12 hours for several days and then every seventh day up to 56 days. Wind speed and precipitation were measured at 20-min intervals during the study. No rain occurred during the first six days following fallout application, and during the first 12-hr period when wind speeds averaged 0.5 mphr an average of 18.5% of the initial contamination was removed. The smaller particles were removed first and wind speeds of 1.1 mph were necessary to remove larger particles. Plant growth habits and leaf characteristics influenced particle retention during the first few days, but differences between the rate of decrease in relation to fallout particle size and plant species became insignificant after about one week of exposure to wind and rain. (CH)

**838** FATE OF A RADIONUCLIDE IN THE AQUATIC ENVIRONMENT: A MATHEMATICAL EQUATION REPRESENTING RADIONUCLIDE UPTAKE BY ALGAE. Gertz, S. M. Philadelphia; Drexel Univ. (1973). 128p. University Microfilms Order No. 73-18,302.

Thesis (Ph. D.).

A mathematical model depicting the fate of a radionuclide at the first trophic level was developed. The fate of a contaminant in the aquatic ecosystem will depend on the levels attained in algae, as they are the starting point of the aquatic food chain. Chlamydomonas reinhardii, a common fresh water alga, was the target organism; cesium-137 was the model radionuclide. A new use of the flow culture technique led to the development of a second degree exponential function to best describe the steady state cesium-137 levels accumulated by Chlamydomonas reinhardii. The influences controlling this accumulation were the phosphate and sodium concentrations, and the algal biomass. Temperature, algal reproduction rate, and potassium and chloride concentrations had no effect on cesium-137 concentration by Chlamydomonas reinhardii. All the accumulated cesium was found intracellularly; there was no cell wall uptake by living algal cells. Active transport appeared to be a probable mechanism for cesium-137 accumulation by Chlamydomonas reinhardii. (Diss. Abstr.)

### *Microorganisms*

**839** $D_2O$-INDUCED FILAMENT AGGREGATION IN THE MICRONUCLEUS OF A CILIATE. Hauser, M.; Beinbrech, G. (Univ., Bochum, Ger.). Z. Naturforsch.; 28C: No. 5-6, 339-341 (1973). (In German).

The large spindle-shaped micronucleus of Paramecium bursaria contains filaments of about 60 A diameter between numerous highly condensed chromosomes. Following treatment for several hours with 70% heavy water the nucleus becomes stretched to several times its original length. The filaments, whose number increases noticeably, then appear as an aggregate, which exhibits a somewhat paracrystalline arrangement. An examination of the filament aggregate by means of a laser diffractometer yielded two diffraction lines corresponding to longitudinal periodicities of 91 to 99 and 160 to 195 A. Since both periodicities are comparable to those reported for microtubular proteins, it is assumed the filaments reported here could be related to microtubular material. (auth)

**840** LOCALIZATION AND RETENTION OF $^{32}$P AND $^{45}$Ca WITHIN SURFACE DEPOSITS OF STREPTOCOCCUS SANGUIS AND THE INFLUENCE OF SUCH DEPOSITS ON THE RELEASE OF THESE ISOTOPES FROM ENAMEL. Bowden, G. H.; Nash, R.; Speirs, R. L. (London Hospital Medical Coll.). Caries Res.; 7: No. 3, 185-200(1973).

The uptake of $^{32}$P by viable deposits of Streptococcus sanguis grown on wires in broth was largely dependent upon the presence of an external carbohydrate source. Viable deposits in the absence of carbohydrate, and also deposits in which the cells had been killed, showed relatively little uptake. Metabolized $^{32}$P was located mainly in the nucleic acids fraction. $^{32}$P was retained within the viable cells upon extraction of deposits with saline for 96 h at 37°C and acid saline pH 3.5 (lactic acid) for 72 h at 37°C. Destruction of matrix with dextranase did not liberate a significant amount of "bound" phosphorus. A possible source of the phosphorus liberated from viable cells in the absence of carbohydrate could be cellular RNA, which has been reported to be utilized by some bacteria during endogenous metabolism. In contrast, $^{45}$Ca showed no selective uptake by deposits and was rapidly removed upon aqueous extraction. The release of both $^{45}$Ca and $^{32}$P from enamel was restricted by surface deposits containing viable and dead cells. The metabolism of phosphorus by viable cells, and the "ion barrier" effects of the deposits which continue after death of the cells, might explain the histological appearance of the in vitro enamel carious lesions described in a previous study. (auth)

## New Tracer Techniques

***Refer also to abstracts 23, 122, 209, 218, 219, 621, 684, and 767.***

**841** (CONF-730525-, pp 196-202) STABLE ISOTOPES AND THE STUDY OF THE BRAIN AND BEHAVIOR. Samuel, D. (Weizmann Inst. of Science, Rehovot, Israel). 1973.

From first international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

Owing to a wide range of behavioral effects encountered when using deuterium-labeled molecules (water) in experiments on brain chemistry and animal behavior, attention has focused on the heavier nuclides such as $^{13}$C, $^{15}$N, and $^{18}$O for which behavioral isotope effects have been negative. Psychobiological studies using $^{18}$O tracer techniques are described including studies on oxygen metabolism in various behavioral situations in rats and studies on the turnover and location of catecholamines in brain. (ERB)

**842** (CONF-730525-, pp 246-251) MEASUREMENT OF THE EFFECTS OF ISOTOPIC DISCRIMINATION WHERE $^{15}$N IS USED AS A TRACER IN A COMPLEX SYSTEM. Edwards, A. P. 1973.

From first international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

The hypotheses that net isotope effects will be reflected in differences between the answers obtained from the use of $^{15}$N-depleted and $^{15}$N-enriched fertilizers, and that materials containing different levels of enrichment will behave identically, are supported by the data obtained from a 3-week incubation experiment. The techniques described are applicable to a variety of soil-fertilizer systems for which the tacit assumption of identical behavior for the isotopes $^{14}$N and $^{15}$N cannot safely be made. Of particular interest are those systems from which large losses of N may occur by volatilization or leaching, and those to which large amounts of readily-available energy materials have been added. (auth)

**843** (CONF-730525-, pp 274-284) NONRADIOACTIVE MULTILABELED MOLECULAR TRACERS IN BIOMEDICAL RESEARCH. Anbar, M.; McReynolds, J. H.; Aberth, W. H.; St. John, G. A. (Stanford Research Inst., Menlo Park, CA). (Argonne National Lab., Ill. (USA)). 1973.

From first international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

Proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

A relatively new application of stable isotopes, namely, their use for multilabeling of organic molecules is reviewed. This methodology is made practical and free of artifacts by the use of field ionization mass spectrometry. The principal advantages of this methodology and the instrumentation techniques used are discussed and a number of research problems attacked at present at the Stanford Research Institute (SRI) using molecular tracers are described. (auth)

**844** (CONF-730525-, pp 299-309) USE OF STABLE ISOTOPES IN STUDIES OF DRUG METABOLISM. Horning, M. G.; Stillwell, W. G.; Nowlin, J.: Lertratanangkoon, K.; Carroll, D.; Dzidic, I.; Stillwell, R. N.; Horning, E. C.; Hill, R. M. (Baylor Coll. of Medicine, Houston). 1973.

From first international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

In these studies, drugs labeled with carbon-13 were used only as internal standards for quantification. However, drugs labeled with stable isotopes can also be used as tracers in studies of drug metabolism in man. The isolation procedures and analytical systems described make it possible to carry out studies of pool size, pharmacokinetics, and drug-drug interaction with very small biological samples. (auth)

**845** (CONF-730525-, pp 310-320) QUADRUPOLE MASS FRAGMENTOGRAPHY IN DRUG RESEARCH. Strong, J. M.; Fies, W. J.; Atkinson, A. J. Jr. (Northwestern Univ., Chicago). 1973.

From first international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

Quantitative mass fragmentography has made it possible to solve analytical problems in animal and human pharmacology that are important in drug research. We have developed an approach to mass fragmentography which uses a quadrupole gas chromatograph-mass spectrometer. This instrument has adequate sensitivity and precision for mass fragmentography and offers advantages over magnetic sector instruments with respect to ease of operation, wide range of ion monitoring and cost. The utility of this approach in pharmacology has been shown through studies in man and rats in which plasma levels of lidocaine and its active N-dealkylated metabolites were measured with a high degree of specificity. These plasma level studies helped lead to important clinical conclusions and demonstrated certain pitfalls in conventional dose-response studies of drug potency. The technique of quadrupole mass fragmentography also should have a ready application to work with stable isotopes. (auth)

**846** (CONF-730525-, pp 326-344) IMPORTANCE OF STABLE ISOTOPE LABELED DRUGS IN CLINICAL PHARMACOLOGY WITH ILLUSTRATIONS FROM STUDIES ON THE DISPOSITION OF PROPRANOLOL AND NORTRIPTYLINE IN MAN. Gaffney, T. E.; Knapp, D.; Walle, T.; Privitera, P.; Saelens, D. 1973.

From first international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

Pharmacology and clinical pharmacology suffer from a lack of rigorous structural and quantitative information on the disposition of drugs in patients with disease. Stable isotope labeled drugs will make an important contribution to pharmacology as they aid GC-MS techniques in the acquisition of this type of information and facilitate earlier, safer, and more complete human drug metabolism studies in adults as well as in children and during pregnancy. Ultimately, this information will help achieve one of the most important goals in medical practice, namely, the optimum dose of effective and safe drugs for the individual patient. (auth)

**847** (CONF-730525-, pp 346-352) STABLE ISOTOPE-MASS SPECTROMETRY IN DRUG METABOLISM AND PHARMACOKINETICS. Sadee, W.; Finn, C.; Castagnoli, N.; Garland, W. (Univ. of Southern California, Los Angeles). 1973.

From first international conference on stable isotopes in chemistry, biology, and medicine; Argonne, Illinois, USA (9 May 1973).

In proceedings of the first international conference on stable isotopes in chemistry, biology, and medicine.

The 3-hydroxylation of diazepam to yield 3-hydroxydiazepam was investigated in an attempt to study the NADPH-dependent oxygenation of nitrogen containing compounds. The source of oxygen was identified by high and low resolution mass spectrometry as molecular oxygen using separate microsomal incubations with $^{18}$O enriched $H_2O$ and $O_2$. The $^{18}$O enriched acetic anhydride induced rearrangement of acetoxydiazepam to diazepam N-4-oxide was studied as a chemical model for the possible role of the N-oxide as enzymatic intermediate, which undergoes N to C oxygen migration. The retained N-oxide $^{16}$O could be located in acetoxydiazepam by analyzing the parent ion and key fragments. In a separate study, human plasma and urine levels of diazoxide were measured in four patients by stable isotope dilution-GC-mass fragmentography. $d_3$-Diazoxide served as internal standard. Conditions were developed to prevent the exchange of the label during derivatization for GC and on column. Sensitivity by repetitive scanning over the parent ions was 1 ng diazoxide/sample. (ERB)

**848** (ORAU-121) BIBLIOGRAPHY OF MEDICAL USES OF TECHNETIUM-99m, 1965–1971. Stemple, R. M. (comp.). (Oak Ridge Associated Universities, Inc., Tenn. (USA). Medical Div.). Jul 1973. 255p. Dep. NTIS $7.60.

References are presented to some 1600 publications that appeared between 1965 and 1971 on applications of $^{99m}$Tc in nuclear medicine. A keyword index is included. (CH)

**849** (ORNL-4867, pp 163-180) MEDICAL INSTRUMENTATION GROUP. Bell, P. R.; Ross, D. A.; McClain, W. J.; McKeighen, R. E.; James, G. D.; East, J. K.; Moore, E. C. Oct 1973.

In Molecular Anatomy (MAN) Program. Semiannual progress report, September 1, 1972–February 28, 1973.

The development of a computer-based scanning system for use in nuclear medicine is discussed. The proposed instrument requires 40 detecting crystals (3-in. NaI cylinders) arranged in 20 opposed pairs, with 20 crystals above the patient and 20 below. Each crystal must have a collimator, and each of these will have 37 hexagonal holes, all aimed at a common point inside the patient. Activities related to the development of the scanner are discussed. (CH)

**850** MORPHOLOGICAL AND FUNCTIONAL RENAL STUDIES USING SCINTIGRAPHY WITH TECHNETIUM FERROUS ASCORBATE. Dubois, D.; Nouel, J. P.; Fillastre, J. P. (Centre Henri-Becquerel, Rouen, France). J. Urol. Nephrol.; 78: 764-768(Sep 1972). (In French).

The preparation of a new complex of technetium ferrous ascorbate with a labeling yield of 95% has made it possible to undertake in man a morphological and functional renal study. Two-hundred and fifty scintigraphs were made. The images are of good quality, the renal distribution of the isotope is homogeneous, and the renal contours are well limited. The dynamic study made it possible to make conclusions on the separate functional value of the kidneys. There is a directly proportional relation between the percentage of renal fixation and the clearance values of the urea and creatinin. (tr-auth)

**851** INFORMATION COMMONLY OBTAINED USING THYROID SCINTIGRAPHY. Tauxe, N. (Mayo Clinic, Rochester, MI). pp 103-113 of Fourteenth Colloquium on Nuclear Medicine. Vol. 1. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972). (In French).

From 14th colloquium on nuclear medicine; Tours, France (9 Jun 1972).

Scintiscanning studies of the thyroid must take into account the differences between the iodine uptake behavior in the United States and Europe. European goiters appear to differ from American goiters. Since the introduction of $T_3$, $T_4$, and TSH measurements, the demand for thyroidian scintigraphy has decreased. Nevertheless the information provided by scintigraphy is still important. The radioisotope used for this purpose is $^{99m}$Tc. (FR)

**852** CRITICAL STUDIES OF SCINTISCANNING IN THYROID PATHOLOGY. Guinet, P.; Biere, J. (Hospital de l'Antiquaille, Lyon). pp 115-121 of Fourteenth Colloquium on Nuclear Medicine. Vol. 1. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972). (In France).

From 14th colloquium on nuclear medicine; Tours, France (9 Jun 1972).

The radioisotope scintiscanning exploration method provides essentially topographic and accessory functional information i.e. the information provided in thyroidian pathology covers limiting regions where the method is irreplaceable. Fixed or movable detectors are used together with particular radioisotopes (principally $^{131}$I, $^{125}$I, and $^{99m}$Tc. In this way it is possible to identify the nodule isolated from the bulk of the thyroid, the multiheteronodular goiter, Basedow's disease, thyroidian linguale ectopy, hypothyroidy, thyroidites, and extra-thyroidian tumors. (FR)

**853** GAMMA ANGIOCARDIOGRAPHY. Floyrac, R. (Centre Hospitalier Regional Bretonneau, Tours, France). pp 270-284 of Fourteenth Colloquium on Nuclear Medicine. Vol. 1. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972). (In French).

From 14th colloquium on nuclear medicine; Tours, France (9 Jun 1972).

The utilization of scintillation cameras has brought new possibilities to cardiopulmonary hemodynamic methods by adding to the quantitative data obtained, a direct visual display of the radioactive embol: radiocardiography has thus become gamma angiocardiography. The installations used are becoming increasingly elaborate, the latest being provided with a digital computer for the processing of dynamic data. One of the most interesting results is the measurement of cardiac cavities and in particular that of the left ventricle. (FR)

**854** EFFECT OF DIAPHYSEAL SURGERY ON RADIOACTIVITY IN THE ZONE OF GROWTH OF LONG BONES. Experimental Study. Kery, L.; Lenart, G.; Szasz, I. (Semmelweis Medical Univ., Budapest). Acta Chim. Acad. Sci. Hung.; 13: No. 3, 259-267(1972).

After labeling the long bones of growing rabbits with $^{85}$Sr, radioactivity in the diaphysis was compared with that in the zone of growth. Activity in the zone of growth was found to exceed that in the diaphysis. Surgical management of the diaphysis involving periosteal damage increased specific activity in the zone of growth. (auth)

**855** QUANTITATIVE RADIOISOTOPE ANGIOCARDIOGRAPHY. Weber, M.; dos Remedios, L. V.; Jasko, I. A. pp 300-310 of Fourteenth Colloquium on Nuclear Medicine. Vol. II. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972). (In French).

From 14th conference on nuclear medicine; Tours, France (9 Jun 1972).

A technique is described for the quantitative evaluation of several important blood circulation parameters and which gives a more accurate qualitative diagnosis of heart lesions and lesions of the large vessels. This method is not proposed as a substitute for either heart catherization or contrast angiography. It is simple to effect, well tolerated by the patient, and does not produce any hemodynamic alterations. The measurements take only 30 min to perform and can be repeated as often as necessary. The measurements are accurate and reproducible. The radiation dose is estimated to be less than 2% of that delivered by contrast angiography. The radioisotope used is $^{99m}$Tc. (FR)

**856** UTILIZATION OF THE TER POGOSSIAN CAMERA FOR STUDIES OF CARDIOPULMONARY VASCULAR KINETICS. Gongora, R. (Institut du Radim, Paris); Perdereau, B.; Gongora, G.; Jammet, H. pp 288-299 of Fourteenth Colloquium on Nuclear Medicine. Vol. II. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972). (In French).

From 14th conference on nuclear medicine; Tours, France (9 Jun 1972).

The apparatus used and the results obtained are presented. The interest of this apparatus lies in the possibility of simultaneously effecting morphological kinetic analysis from images integrated during a period of less than 0.1 sec and also in the functional analysis performed, which is simultaneously overall and fragmentary. This camera is in practice highly specialized for studying fast kinetic phenomena and specially designed for cardiopulmonary circulation investigations. (FR)

**857** COMPUTERIZED SCANNING TECHNIQUE FOR DYNAMIC STUDIES OF LEFT AND RIGHT HEART CAVITIES. Davies, H.; Kirch, D. L.; Steele, P. P.; Van Dyck, D. C. (Univ. of California, Berkeley). pp 286–287 of Fourteenth Colloquium on Nuclear Medicine. Vol. II. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972). (In French).

From 14th conference on nuclear medicine; Tours, France (9 Jun 1972).

A method is described for radioisotope angiocardiography that leads to a precise determination of the auricular and ventricular volumes together with an evaluation of the heart function but avoids the traumatisms produced by contrast angiocardiography. The radioisotope $^{99m}$Tc, in the form of pertechnetate is used. An Auger camera connected to a PDP 12 digital computer is employed. (FR)

**858** SCINTISCANNING IN CARDIOLOGY. Planiol, T. (Central Hospitalier Regional Bretonneau, Tours, France). pp 146–164 of Fourteenth Colloquium on Nuclear Medicine. Vol. II. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972). (In French).

From 14th conference on nuclear medicine; Tours, France (9 Jun 1972).

Cardiac scintiscanning used in conjunction with modern nuclear medicine techniques promises to become one of the most precise bloodless methods for diagnosing and treating heart disease involving the myocardial and pericardial cavities. The method completes dynamic radioisotope analysis and is one of the best guides for radiological examination of contrast. The number of such examinations carried out before, during, and after medical treatment can be reduced as well as those carried out subsequent to surgical operations. (FR)

**859** RESULTS OF IN VIVO AND IN VITRO TESTS FOR THE EXPLORATION OF THE THYROID FUNCTION. Tubiana, M.; Fragu, P.; Bazin, J. P. (Institut Gustave Roussy, Villejuif, France). pp 67–82 of Fourteenth Colloquium on Nuclear Medicine. Vol. I. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972), (In French).

From 14th conference on nuclear medicine; Tours, France (9 Jun 1972).

Various tests are available for exploring the thyroidian function. The current utilization of $T_4$ assays and measurements of free $T_4$ represents a considerable progress in the subject that has changed its strategy with regard to functional exploration of the thyroid resulting in the nonutilization of some of the information provided by $^{131}$I and the simultaneous appearance of Tc scintiscanning techniques. In addition, these tests lead to direct measurements of the thyroidian activity that are useful for the discrimination between "eu" and "hyper" thyroidian effects. (FR)

**860** STUDY OF THE UPTAKE OF TRIIODOTHYRONINE BY ALBUMIN MICROSPHERES IN PLASMA SERUM IN THE FRAMEWORK OF THYROID FUNCTION STUDIES. Rolleri, E.; Buzzigolli, G.; Plassio, G. (Societa Ricerche Impianti Nucleari, Saluggia, Italy). pp 51–61 of Fourteenth Colloquium on Nuclear Medicine. Vol. I. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972). (In French).

From 14th conference on nuclear medicine; Tours, France (9 Jun 1972).

A test is described in which albumin serum microspheres are used as a reversible adsorbant. The standardization of the method is discussed together with the operational procedure adopted. Clinical results are presented and a correlation table is established with other diagnostic tests of the thyroidian function. The method appears to meet perfectly adequately the requirements of the $T_3$ test concerning accuracy, discriminating power, operational simplicity, and rapidity. (FR)

**861** THYROIDIAN EXPLORATION USING IN VITRO RADIOISOTOPE METHODS. Beckers, C. (Univ., Louvain, Belg.). pp 27–39 of Fourteenth Colloquium on Nuclear Medicine. Vol. I. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972). (In French).

From 14th conference on nuclear medicine; Tours, France (9 Jul 1972).

Methods are presented for determining extremely small concentrations of circulating thyroidian hormones or thyreostimuline (of the order of micrograms or nanograms per ml). In addition, these methods do not require any administration of radioisotopes to the patients. The following in vitro tests are used in thyroidian pathology: $T_3$ transfer tests; assay for thyroxine in the serum; assay for triiodothyronine in the serum; measurement of the free fraction of circulating thyroidian hormones; assay for thyreostimuline in the serum; detection of circulating iodoproteins; and detection of antithyroidian antibodies. (FR)

**862** SELECTIVE SCINTIGRAPHIC LYMPHOGRAPHY ON THE TESTES. Spaventi, S.; Agbaba, M.; Bosnar, M.; Paic, G.; Keros, P. (Allgemeines Krankenhaus, Zagreb). Nucl.-Med.; 12: No. 2, 148–153(1973).

Selective scintigraphic lymphography of the testes is a new simple method of regional lymph node visualization with colloidal radioactive gold $^{198}$Au. The value of the method was confirmed in 79 cases of testicular tumors. Using conventional methods of calculation, the radiation doses involved were estimated. (auth)

**863** METABOLISM OF TRITIUM- AND $^{14}$C-LABELLED PYRIDOXINE IN THE RAT. Johansson, S.; Tiselius, H. G. (Karolinska Sjukhuset, Stockholm). Scand. J. Clin. Lab. Invest.; 32: No. 1, 9–14(Aug 1973).

Studies on the metabolism of different forms of vitamin $B_6$ in vivo require the use of labeled compounds with high specific radioactivity. Tritium-labeled pyridoxine has therefore been used in several studies. Since tritium is lost in the metabolic conversion of pyridoxine, the distribution of tritium in ($^{3}H_6$) pyridoxine prepared by exposure of pyridoxine to tritium gas has now been determined and the metabolism of ($^{3}H_6$) pyridoxine in rats compared with that of (4,5$-^{14}C_2$) pyridoxine. Oxidation of ($^{3}H_6$, 4,5$-^{14}C_2$) pyridoxine with potassium permanganate to 4-pyridoxic acid and to 5-hydroxy-6-methylcinchomeronic acid showed that 22% of the tritium was located in the 4-hydroxymethyl group and 21% in the 5-hydroxymethyl group. The isotope-retention curves of tritium and carbon-14 after administration of ($^{3}H_6$, 4,5$-^{14}C_2$) pyridoxine to rats had approximately the same kinetic parameters, indicating that ($^{3}H_6$) pyridoxine may be used to calculate fractional turnover rates of vitamin $B_6$. Two methods for the calculation of the body pool of vitamin $B_6$ were evaluated and found to give comparable results, i.e., approximately 3 mg in rats weighing about 250 g. (auth)

**864** VALIDITY OF THE MYOCARDIAL BLOOD FLOW METHOD UTILIZING XENON-133 FOR DOGS. Application to Studies of the Effectiveness of Mammary Artery Implantation in the Coronary Provoked Ischemia. Serres, P.; Guiraud, R.; Danet, B.; Boccardo, H.; Puel, P. (Centre Hospitalier Universitaire Purpan, Toulouse). pp 234–239 of Fourteenth Colloquium on Nuclear Medicine. Vol. II. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972). (In French).

From 14th conference on nuclear medicine; Tours, France (9 Jun 1972).

Experiments performed on 23 dogs demonstrated an excellent correlation between tissue flow and perfusion flow. The technique for measuring flow using xenon-133 washout gives a very good idea of the real flow. The technique, nevertheless, necessitates a continuous control of the pressure. It enables the identity of the revascular region to be determined using the Vineberg technique together with that of the normal state irrigating artery. However, the flow from the two arteries should not be identical in view of the important differences in the peripheral resistances. (FR)

**865** CALCULATION OF CARDIAC OUTPUT. Mounier, Y.; Guelfi, J.; Melki, G.; Herry, J. Y.; Houy, J. C. (Univ., Rennes, France). pp 230–232 of Fourteenth Colloquium on Nuclear Medicine. Vol. II. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972). (In French).

From 14th conference on nuclear medicine; Tours, France (9 Jun 1972).

In the method described, a Eulerian function of the 2nd kind is substituted for the exponential function describing the emptying of the heart cavity. This new function is calculated from 28 experimental points and is certainly more rigorous. It can be applied to the two successive peaks of the right and left cavities, and must be repeated for each sick patient, the utilization of a computer being absolutely necessary. (FR)

**866** AUTOMATION OF RADIOISOTOPE CARDIAC OUTPUT MEASUREMENTS. Mehier, H.; Gubert, A.; Guey, A.; Heyden, D.; Barbe, R. (Univ., Lyon). pp 222–228 of Fourteenth Colloquium on Nuclear Medicine. Vol. II. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972). (In French).

From 14th conference on nuclear medicine; Tours, France (9 Jun 1972).

A portable apparatus was developed for cardiac output measurements using radioisotopes. The apparatus records and processes the data obtained. Information transmitted by the detector is recorded in digital form on a minicassette type magnetic tape. On another track, 1/100 sec time intervals are recorded. The contents of the tape are dumped into a shift register (512 channels, 16 bits), having a multiscale operation varying with the time base used (0.01 to 10 sec). This memory permits visual display on a T.V. screen of the part of the curve of interest and the processing of the corresponding data. A small computer ensures the following functions: smoothing of the curve; summation of the activity between two time limits; measurement of the activity in i.p.m. on any given number of channels; measurement of the time lapse between two channels selected on the screen; extrapolation to infinity of a selected part of the curve on the screen; automatic calculation of the output and blood volume from previously acquired data. (FR)

**867** AUTOMATIC EVALUATION OF CARDIAC OUTPUT. Burguet, W. (Univ., Liege); Merchie, G.; Champarnaud, J. D.; Haglund, M. E. pp 220-221 of Fourteenth Colloquium on Nuclear Medicine. Vol. II. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972). (In French).

From 14th conference on nuclear medicine; Tours, France (9 Jun 1972).

An automatic method using radioisotopes for the determination of cardiac output is presented. The radiocardiography curve is introduced using a punched tape on the MULTI 8 INTERTECHNIQUE computer coupled to a block memory and a visual display unit (TRIDAC, INTERTECHNIQUE). This method enables the cardiac output and the various parameters dependent on this factor to be obtained in the shortest possible time. (FR)

**868** TRANSMISSION OF ANALOGUE DATA IN REAL TIME BY A VECTOR USING THE AUDIOFREQUENCY RANGE. Particular Applications to Radiocardiography. Barritault, L.; Prieur, G.; Sejourne, C.; Foucher, M.; Agnely, J.; de Vernejoul, P. (CEA, Orsay, France). pp 212-218 of Fourteenth Colloquium on Nuclear Medicine. Vol. II. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972). (In French).

From 14th conference on nuclear medicine; Tours, France (9 Jun 1972).

The transmission of analogue data in real time by a vector using the audiofrequency range facilitates functional explorations in man. Special emphasis is given to the radioisotope dilution curves for the organism, a prototype system being presented which uses the ordinary telephony vector (the hertzian vector) and magnetic tape. The solutions adopted for the emitting and receiving parts are presented together with the restrictions occurring in the utilization of the equipment. The flexibility of the equipment in view of medical applications is underlined. (FR)

**869** CARDIAC OUTPUT AND RADIOCARDIOGRAPHY. de Vernejoul, P. (CEA, Orsay, France). pp 184-211 of Fourteenth Colloquium on Nuclear Medicine. Vol. II. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972). (In French).

From 14th conference on nuclear medicine; Tours, France (9 Jun 1972).

The precordial recording of the dilution curves for a radioactive indicator after its injection upstream from the cardiac cavities led to two types of investigation: measurement of the cardiac flow and radiocardiography. The principle and techniques used to measure the cardiac output are described. The results obtained are examined and compared with those acquired using other methods. The principle and techniques used to measure ventricular volumes are described. The method enables the problem of pulmonary circulation to be studied using a given number of circulation times. Studies of coronary flow were also carried out in order to investigate the characteristics of the method used, its validity, and the results obtained. (FR)

**870** THYROID EXAMINATION WITH RADIONUCLIDES $^{131}$I AND $^{99m}$Tc. Rohacek, J. (Kunz-Krankenhaus, Hradec Kralove, Czech.). Radiobiol.-Radiother.; 14: No. 4, 383-386(1973). (In German).

The thyroid examination with simultaneous administration of $^{131}$I and $^{99m}$Tc is reported. For iodine uptake and iodine metabolism an amount of 4 to 10 μCi $^{131}$I is applied, for scintigraphy 0.5 to 1.0 mCi $^{99m}$Tc-pertechnetate. Six hundred and four examinations were made according to this method and compared with the same number of examinations being made with $^{131}$I only. These are the advantages of thyroid examination with simultaneous administration of $^{99m}$Tc and $^{131}$I: low exposure to the patient; high information value of the scintigram; enlarged possibility of thyroid examination with iodine blocked thyroids; and time saving. A recommendation of this method seems to be justified. (auth)

**871** SPLENIC SCINTIGRAPHY BY $^{99m}$/Tc-LABELED RED CELLS. Uchida, T. (Kyoto Univ.); Kariyone, S.; Nakajima, K. Kaku Igaku; 10: No. 2, 79-89(Apr 1973). (In Japanese).

The method for red cell labeling by $^{99m}$Tc-pertechnetate and damage of labeled cells in a manner that results in their sequestration by the spleen was evaluated to obtain spleen scanning. The standard method for red cell labeling and spleen scanning is as follows; 1) Add 8 ml of the patient's blood to a sterile capped tube containing 2 ml ACD. 2) separate the red cells and plasma by centrifugation and wash the red cells twice with isotonic saline. 3) Add $^{99m}$Tc-pertechnetate in 0.1 to 0.5 ml saline (1 to 3 mCi) to red cells and incubate for 30 min at 37° C. 4) Add 0.1 ml of 100 μg $SnCl_2 \cdot 2H_2O$/ml ACD, freshly prepared as a reducing agent and stand for 10 min at room temperature. 5) Wash twice with isotonic saline and resuspend in the patient's own plasma. 6) Heat the labeled red cells in a 49 ± 0.5° C waterbath for 7 to 10 min. 7) Cool at room temperature and infuse to the patient. The radioactivity of damaged red cells was accumulated to the spleen enough to obtain the suitable scan images. Two methods of $^{51}$Cr-heated red cells and $^{99m}$Tc-labeled cells were compared. No difference was found in spleen size obtained by two techniques. $^{51}$Cr-method was characterized by expressing a whole image of the spleen and $^{99m}$Tc-method by expressing rather superficial or sectional image. Labeling technique of $^{99m}$Tc-method was complicated and it took 2 hrs through all of the procedure. That of $^{51}$Cr-method, on the other hand, was somewhat simple and it took an hour. Splenic radiation was 3 rad with 600 μCi in $^{99m}$Tc-method, since the radioactivity remained in the spleen for only a few hours. In $^{51}$Cr-method, spleen radiation was 5 rad with 200 μCi. (auth)

**872** NEW MODIFICATION OF THE RADIOIMMUNOASSAY FOR HUMAN PROLACTIN. Tamura, S.; Taya, K.; Igarashi, M. (Gunma Univ., Maebashi, Japan). Nippon Naibumpi Gakkai Zasshi; 49: No. 3, 577-579(Mar 1973). (In Japanese).

A new modification of the Jacobs et al's radioimmunoassay method for human prolactin was devised. In this improved method, purified porcine prolactin for iodination, anti-ovine prolactin guinea pig serum for antiserum, and purified porcine prolactin for standard were used respectively. The slope of the dose response curve of the purified porcine prolactin was demonstrated to be parallel to that of diluted sera of postpartum lactating women. Our method is different from the Jacobs et al's method, in using purified porcine prolactin instead of the specific patient serum for standard. The Jacobs et al's method requires to bioassay the prolactin content of the standard patient serum, but our method does not need such complicated procedure. According to our method, the prolactin content in the human serum can be expressed directly in terms of international unit of prolactin. (auth)

**873** DETERMINATION OF SUBSTANCE OF COMPETITIVE RADIOASSAY, AND ITS CLINICAL SIGNIFICANCE. Irie, M. (Toho Univ., Tokyo). Toho Igakkai Zasshi; 20: No. 1-2, 13-18 (Apr 1973). (In Japanese).

Competitive radioassay is a method that is capable of detecting minute amount of substance quantitatively. The principle is the application of competitive phenomenon between unlabeled and labeled substance by radioisotope, against the reactor. This method was developed in 1959, as the radioimmunoassay of insulin. Since then, this method has been employed mainly for the measurement of peptide hormones. Recently, however, many substances other than hormones are being measured by this method. In this special lecture, the outline of the principle, method and application of competitive radioassay was described. Furthermore, the results and the clinical significance of the determination of insulin, growth hormone and TSH (thyroid stimulating hormone) were demonstrated. (auth)

**874** SOLID-PHASE TRIIODOTHYRONINE RADIOIMMUNOASSAY. Siegel, S. J.; Line, W. F.; Yank, N. S. T.; Kwong, A.; Frank, C. (Wilson Labs., Chicago). J. Clin. Endocrinol. Metab.; 37: No. 4, 526-532(Oct 1973).

Anti-triiodothyronine serum covalently linked to agarose produced an immunoadsorbent that retained 50% of the activity of the soluble antibody, and was as specific and sensitive. In addition, the binding of antigen to antibody and the separation of the bound antigen and free antigen are achieved in one step eliminating the necessity of additional antibodies or adsorbents. (auth)

**875** RADIOIMMUNOASSAY OF ARGININE VASOPRESSIN IN HUMAN PLASMA. Husain, M. K.; Fernando, N.; Shapiro, M.; Kagan, A.; Glick, S. M. (Coney Island Hospital, Brooklyn). J. Clin. Endocrinol. Metab.; 37: No. 4, 616-625(Oct 1973).

A highly sensitive specific radioimmunoassay (RIA) method for the measurement of arginine vasopressin (AVP) is described. The sensitivity of the assay is 0.1 pg/ml. A simple extraction technique from plasma is described with a consistent recovery of about 65 to 70%, and without alteration in the immunoreactivity of the extracted hormone. AVP levels, uncorrected for recovery, ranged between 1.3 and 8.5 pg/ml (mean 3.7 pg/ml) in humans after 12 to 25 hr of water deprivation, and were consistently less than 1.2

pg/ml after water loading. AVP levels were undetectable in 6 patients with diabetes insipidus. Smoking was followed by up to several hundred-fold increases in plasma AVP. Plasma AVP levels in animals also rose with dehydration, increased plasma hypertonicity and hypovolemia and fell with hydration. (auth)

**876** $^{99m}$Tc MINICOLLOID FOR RADIONUCLIDE LYMPHOGRAPHY. Dunson, G. L.; Thrall, J. H.; Stevenson, J. S.; Pinsky, S. M. (Armed Forces Radiobiology Research Inst., Bethesda, MD). Radiology; 109: No. 2, 387-392(Nov 1973).

The techniques for compounding a $^{99m}$Tc-sulfur colloid ($^{99m}$Tc minicolloid) and imaging of the lymphatic system are presented. A study comparing this small-particle radiocolloid with commercially available radiocolloids of larger particle size demonstrated the smaller to be a superior agent for lymphatic imaging, probably due to its more favorable migration through successive nodal groups. Advantages of $^{99m}$Tc minicolloid include same-day imaging, lower absorbed dose, and better resolution. (auth)

**877** MYOCARDIAL SCINTIGRAPHY AFTER INTRACORONARY INJECTION OF $^{99m}$Tc-LABELED SERUM ALBUMIN. Weller (Veterans Administration Hospital, Cincinnati); Adolph; Wellman, C.; Kim pp 166-172 of Fourteenth Colloquium on Nuclear Medicine. Vol. II. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972). (In French).

From 14th conference on nuclear medicine; Tours, France (9 Jun 1972).

Myocardial scintigraphies were carried out on 30 dogs after injecting $^{99m}$Tc-labeled serum albumin microspheres into their coronary arteries. It was possible, in this way, to establish the normal myocardial scintigram of dogs, and also to detect infarcts as small as 1.5 cm. Toxicological studies did not indicate the existence of pathological modifications. Macroscopic and microscopic examinations made from the first up to the sixth week yielded identical results to those obtained with reference dogs. Studies effected on 38 sick animals did not reveal any secondary reactions, the scintigrams enabling anatomic details, which were not detected by other isotopic techniques, to be observed. (FR)

**878** SIMULTANEOUS MEASUREMENT OF THYROIDAL TRAPPING ($^{99m}$TcO$^{4-}$) AND BINDING ($^{131}$I$^-$): CLINICAL AND EXPERIMENTAL STUDIES IN MAN. Hays, M. T.; Wesselossky, B. (Univ. of California, Los Angeles). J. Nucl. Med.; 14: No. 11, 785-792(Nov 1973).

Thyroidal uptake was measured repeatedly after simultaneous intravenous administration of $^{99m}$TcO$_4$ and $^{131}$I to assess the thyroidal trapping mechanism ($^{99m}$TcO$_4$) as well as combined trapping and binding ($^{131}$I). Studies in controls (n = 43) showed a mean thyroidal (neck minus thigh) $^{99m}$TcO$_4$ uptake of 3.5% reached within 10 to 20 min, followed by a gradual decrease. Iodine-131 uptake curves were normal. In hyperthyroidism (n = 9), uptake of both radionuclides was increased. In untreated hypothyroidism and in goiter with low $^{131}$I uptake (n = 7), $^{99m}$TcO$_4$ uptake appears by this technique to be greater than the $^{131}$I uptake. In a series of normal volunteers, thyroid space (from T/S ratio) as well as thyroidal uptake were determined. TSH administration (n = 7) stimulated the thyroidal uptake and the thyroid space of both radionuclides. Triiodothyronine (n = 7), while markedly reducing $^{131}$I thyroidal uptake and space, had no effect on measurements of thyroidal $^{99m}$TcO$_4$ concentration by this technique although suppression could be demonstrated by a more specific technique. Propylthiouracil (n = 5) also reduced $^{131}$I thyroidal uptake and the $^{131}$I space. It did not affect $^{99m}$TcO$_4$ uptake but increased the $^{99m}$Tc space. Lugol's solution (n = 6) virtually obliterated both thyroidal uptake and space for both radionuclides. This method uses generally available equipment and is useful in detecting the stimulation of trapping seen in hyperthyroidism and after TSH stimulation. Caution is advised when uptake levels are low because of the large, variable concentration of pertechnetate in nonthyroidal neck tissues. To study low $^{99m}$TcO$_4$ uptakes, techniques which specifically identify thyroidal radioactivity must be used. (auth)

**879** WHOLE-BODY RETENTION OF $^{67}$Ga-CITRATE. Watson, E. E.; Cloutier, R. J.; Gibbs, W. D. (Oak Ridge Associated Universities, TN). J. Nucl. Med.; 14: No. 11, 840-842 (Nov 1973).

The retention of $^{67}$Ga-citrate in patients with neoplastic diseases was measured with a whole-body counter that has a counting efficiency essentially independent of patient size and radionuclide distribution. From 2 to 5 mCi of $^{67}$Ga-citrate were administered to each patient. Stable gallium constituted <3 μg/dose. The whole-body counting results were analyzed to determine whether differences in uptake and retention could be related to sex or age of the patients. Although there was great variation among patients, biological half-time of the $^{67}$Ga was longer in the females than the half-times in the males. No significant differences could be shown to relate to the patients' ages. (auth)

**880** PROLONGED RETENTION OF RADIOACTIVITY FOLLOWING PERFUSION LUNG SCAN IN ASTHMATIC PATIENTS. Busse, W.; Reed, C.; Tyson, I.; Birnbaum, M. (Univ. of Wisconsin, Madison). J. Nucl. Med.; 14: No. 11, 837-839(Nov 1973).

Abnormalities of the perfusion lung scan during acute asthmatic episodes are well known. Prolongation of the biological half-life of $^{131}$I-macroaggregated albumin (MAA) was not previously reported. Evaluation of the biological clearance of MAA from the lungs in 14 patients with asthma (7 males and 7 females) showed substantial prolongation in 12 patients. This phenomenon is not specific to asthma but was observed in patients taking steroids, immunosuppressive therapy, viral pneumonia, and chronic interstitial lung disease. (auth)

**881** MEASUREMENT OF $^{127}$I CONCENTRATION IN THYROID TISSUE BY X-RAY FLUORESCENCE. LeBlanc, A. D.; Bell, R. L.; Johnson, P. C. (Methodist Hospital, Houston, TX). J. Nucl. Med.; 14: No. 11, 816-819(Nov 1973).

X-ray fluorescence was used to determine the iodine content of surgically removed thyroids that had been preoperatively scanned with $^{131}$I. Iodine concentrations were determined for tissues classified as normal, papillary-follicular carcinoma, chronic thyroiditis, and colloid nodules of adenomatous thyroids. The iodine concentration of these thyroid states varied, with carcinomatous tissue having the lowest concentration and normal tissue the highest. There was considerable overlap among the various pathological states. Nodules showing increased $^{131}$I activity on the presurgical thyroid scan contained no more iodide than normal tissue, while nodules showing decreased $^{131}$I activity contained considerably less iodine. The residual $^{131}$I from the presurgical dose showed a distribution similar to the distribution of stable iodine. The iodine concentration of normal thyroid tissue obtained from autopsy specimens was determined to be about 2.5 times greater than the levels reported in the older literature. (auth)

**882** TIMING OF INTRACRANIAL BLEEDING IN NEWBORN INFANTS. (Vanderbilt Univ., Nashville). Dyer, N. C.; Brill, A. B.; Tsiantos, A. K.; Sell, E.; Victorin, L. H.; Stahlman, M. T. J. Nucl. Med.; 14: No. 11, 807-811(Nov 1973).

Red blood cells labeled with the stable tracer $^{50}$Cr were used to investigate the timing of intracranial bleeding in immature newborn infants who required intensive nursery care. The median age at tagging the infant's red blood cells was 7.5 hr after birth. Of 69 infants from whom intraventricular clot samples were obtained at autopsy, 45 infants had the hemorrhage after tagging. In 18 infants part of the hemorrhage occurred before tagging and part afterwards. In six infants the hemorrhage occurred before tagging. For the 31 infants on whom a more precise estimate of the hemorrhage time was available, the data indicated that the intracranial bleeding occurred near the time of death. It is concluded that most of these infants' intracranial bleeding occurred after birth and after their disease process was clearly established. The use of the stable isotope $^{50}$Cr for the tagging of donor red cells was found to be a safe and practical method. The application of stable tracers, neutron activation analysis, and high-resolution gamma-ray spectroscopy has provided a tool for clinical investigations on high radiation risk subjects such as newborn infants without the administration of radioisotopes. (auth)

**883** SPECIES VARIATIONS IN BINDING OF $^{63}$Ni(II) BY SERUM ALBUMIN. Callan, W. M.; Sunderman, F. W. Jr. (Univ. of Connecticut, Farmington). Res. Commun. Chem. Pathol. Pharmacol.; 5: No. 2, 459-472(Mar 1973). (COO-3140-15).

Equilibrium dialysis was employed in order to compare the in vitro binding of $^{63}$Ni(II) by purified serum albumin from five mammalian species. These measurements showed that the $^{63}$Ni(II) affinities of canine and porcine serum albumins are substantially less than the affinities of human, rabbit, and rat serum albumins. Thus, when 0.05 mM solutions of albumins from the five species were dialyzed at pH 7.4 against an equimolar solution of $^{63}$NiCl$_2$, 87 to 89% of total $^{63}$Ni(II) became bound to human, rabbit, and rat serum albumins, compared to values of 77% and 55% of total $^{63}$Ni(II), which became bound to porcine and dog albumins, respectively. These species variations in the affinities of albumin for $^{63}$Ni(II) are responsible, at least in part, for species differences in the proportions of serum ultrafiltrable and protein-bound nickel. (auth)

**884** RADIOIMMUNOASSAY FOR MEASUREMENT OF SERUM THYMIDINE. Hughes, W. L.; Christine, M.; Stollar, B. D. (Tufts Univ., Boston). Anal. Biochem.; 55: No. 2, 468-478(Oct 1973).

A simple and sensitive radioimmunoassay for the measurement of serum thymidine was developed based on the competition between thymidine and an analog ($^{125}$IUdR) for sites on anti-thymidine antibody. Antibody-bound $^{125}$IUdR was measured in ammonium sulfate precipitates. None of the structurally related compounds that are normal body metabolites showed thymidine's ability to displace the label except at 200-fold higher concentration. A thymidine concentration of slightly greater than $10^{-6}$M was measured in mouse blood serum. The rate of disappearance of a thymidine load from the bloodstream was followed after intravenous administration. The sensitivity and specificity of the technique are discussed, and applications in radiotherapy and chemotherapy depending on altered DNA synthesis or cell death are suggested. (auth)

**885** SERUM TRIIODOTHYRONINE ASSAYS IN THYROID PATHOLOGY. Nouel, J. P. (Centre Henri Becquerel, Rouen, France); Chaumant, J.; Brunelle, P.; Bohoun, C. pp 93-97 of Fourteenth Colloquium on Nuclear Medicine. Vol. 1. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972). (In French).

From 14th colloquium on nuclear medicine; Tours, France (9 Jun 1972).

Triiodothyronine assays currently practicable serve as an excellent test for studies of the thyroidian function. The diagnostic value is greater than the free thyroxine index, the association of these two tests enabling a classification to be made of various dysthyroidies with almost absolute certainty. The test renders possible much physiopathological research and will undoubtedly serve as a base for studies of the hypothalamo-hypophyso-thyroidian function. (FR)

**886** RADIOIMMUNOASSAY OF PLASMA SERUM TRIIODOTHYRONINE. Brunelle, P. (Centre Henri Becquerel, Rouen, France); Nouel, J. P.; Drouet, J. pp 41-50 of Fourteenth Colloquium on Nuclear Medicine. Vol. 1. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972). (In French).

From 14th colloquium on nuclear medicine; Tours, France (9 Jun 1972).

A radioimmunoassay method for serum triiodothyronine is presented that does not involve prior extraction. Antibodies were obtained from rabbits following injections of triiodothyronine coupled with human albumin. The antibody is reacted with $^{125}$I-labeled triiodothyronine (having a high specific activity). When equilibrium is reached, the antigen-antibody complex is precipitated by a second rabbit antibody-antiglobulin. The assay is expressed as a percentage of the activity of the tubes containing only radioactive triiodothyronine. (FR)

**887** DIAGNOSTIC VALUE OF VARIOUS FUNCTIONAL THYROID TESTS USING CORRESPONDENCE ANALYSIS. Ducassou, D. (Institut National de la Sante et de la Recherche Medicale, Bordeaux); Cathalinat, B.; Blanquet, P.; Kerbaol, M.; Latapie, J. L.; Gasparoux, S. pp 91-92 of Fourteenth Colloquium on Nuclear Medicine. Vol. 1. Tours, France; Centre d'Etude des Methodes Physiques d'Exploration Fonctionnelle (1972). (In French).

From 14th colloquium on nuclear medicine; Tours, France (9 Jun 1972).

Analysis of "correspondences" enables simultaneous definitions to be obtained for the "distances" actually existing between biological characters and individuals. The analysis presented was carried out using biological data obtained from patients suffering from endocrinian troubles. The results enable the variation in the representations of various diagnosis zones to be appreciated by choosing only a limiting number of parameters. They also permit in the case of treated Basedow's disease the determination of which patients are benefitting the most. (FR)

**888** USING KINETIC ANALYSES OF UPTAKE OF CARBON-14 TO MEASURE RATES OF MOVEMENT OF INDIVIDUAL ORGANIC COMPOUNDS INTO AQUATIC BACTERIA. Hobbie, J. E. pp 207-214 of Modern Methods in the Study of Microbial Ecology. Rosswall, T. (ed.). Stockholm; NFR, Editorial Services (1973).

From conference on modern methods in the study of microbial ecology; Uppsala, Sweden (19 Jun 1972).

A method of measuring rates of movement of some organic compounds into bacteria is described. The principle of the method is that a small amount of isotope, for example glucose-$^{14}$C, is added to a sample of water with bacteria. After $^{1}/_{2}$ to 4 hrs the amount of $^{14}CO_2$ is determined. The techniques were developed for heterotrophic aquatic bacteria but they can be used equally as well for terrestrial studies. (SW)

**889** ISOTOPIC TECHNIQUE FOR MEASURING THE AUTOTROPIC ACTIVITY OF SOIL MICROORGANISMS IN SITU. Smith, D. W.; Fliermans, C. B.; Brock, T. D. pp 243-246 of Modern Methods in the Study of Microbial Ecology. Rosswall, T. (ed.). Stockholm; NFR, Editorial Services (1973).

From conference on modern methods in the study of microbial ecology; Uppsala, Sweden (19 Jun 1972).

A method for in situ measurement of the activity of microorganisms in soil is described. The technique is an inexpensive and simple wet oxidation method of assessing the incorporated radioactivity in soil. Since the isotope is added as gaseous $^{14}CO_2$, no alteration in the ionic strength or moisture content of the soil occurs. (SW)

**890** AUTORADIOGRAPHIC TECHNIQUES TO DETECT ACTIVE MICROBIAL-CELLS IN NATURAL HABITATS. Waid, J. S.; Preston, K. J.; Harris, P. J. pp 317-322 of Modern Methods in the Study of Microbial Ecology. Rosswall, T. (ed.). Stockholm; NFR, Editorial Services (1973).

From conference on modern methods in the study of microbial ecology; Uppsala, Sweden (19 Jun 1972).

An autoradiographic technique of differentating metabolically active hyphae on decomposing beech leaves from those hyphae that are inactive or dead is described. Fungal colonization of leaves was studied in a field experiment. The leaves were immersed in uniformly labeled $^{14}$C-glucose solution. Surface hyphae were removed. Autoradiograms were prepared using liquid photographic emulsion. Controls indicated that there was no adsorption or nonmetabolic uptake of radionuclide by hyphae. From the slides the total length of mycelium and of radioactive mycelium was determined. (SW)

**891** RADIOIMMUNOASSAY. Pikler, G. M. (Mayo Clinic, Rochester, MN). Rev. Invest. Clin. (Mex.); 25: No. 1, 51-66(1973). (In Spanish).

The field of clinical endocrinology has seen a revolutionary advancement with the introduction of the radioimmunoassay technique by Berson and Yalow in 1960. This technique is far more sensitive and specific than any other previous assay method used. It measures the immunologic and not biologic activity of a hormone as opposed to the bioassay. Two initial requirements are necessary to develop a radioimmunoassay: a pure hormone and an animal capable of making high concentrations of antibody to the hormone. The radioimmunoassay exploits the ability of unlabeled hormone in biologic fluids or standard solutions to compete with the labeled hormone for the antibodies. The principle of the radioimmunoassay has recently been applied to the assay of numerous non-protein hormones and many other non-hormonal substances. This technique has opened areas of investigation that were difficult to approach before and has become one of the most important laboratory tools in clinical endocrinology. (ERB)

**892** NUCLEAR MEDICINE AND RADIOCHEMISTRY. Goette, H.; Kloss, G. (Farbwerke Hoechst AG, Frankfurt am Main). Angew. Chem. Int. Ed. Engl.; 12: No. 9, 712-721(Sep 1973).

Nuclear medical diagnostic methods are widely used at present, examples being neoplasm localization in the thyroid, the kidney, and the spleen, and function tests, e.g., on the thyroid and on the liver. For these tests it is essential to have organ-specific carrier substances that can be labeled with suitable radionuclides. For in-vivo investigations, the exposure of the patient to radiation should be kept as small as possible, but the radiation must nevertheless be sufficient to allow the detection of the nuclide. Today, the therapeutic use of radionuclides is small in comparison with their use in diagnosis. (auth)

**893** PHARMACEUTICAL PRODUCTS HAVING APPLICATIONS IN DIAGNOSIS. (to Commissariat a l'Energie Atomique). French Patent 2,143,600. 1 Jul 1971. 8p. (In French).

New pharmaceutical products acting as direct tracers or as intratumoral cellular tracers and used in particular in conjunction with scintiscanning for the detection of tumors are presented. The basic substance is in the case of bleomycin, a polypeptide, which chelates a metallic cation presenting radioactive properties (in particular $\gamma$ emitters: $^{57}$Co, $^{58}$Co, $^{67}$Cu). The manufacture of these products as well as the diagnosis carried out are described. (FR)

**894** PURIFICATION OF $^{14}$C-LABELED DEOXYRIBONUCLEASE 2 FROM HeLa S3 LYSOSOMES AND ITS USE AS A MARKER FOR THE STUDY OF NUCLEAR DEOXYRIBONUCLEASE 2. Slor, H. (Tel Aviv Univ., Isreal). Biochem. J.; 136: No. 1, 83-87(Sep 1973).

$^{14}$C-labelled lysosomal DNAase II was purified and added to HeLa S3 cells during isolation of their nuclei. The study demonstrated no specific binding of lysosomal DNAase II to the nuclear fraction and it is concluded that DNAase II activity observed in isolated nuclei represents an intrinsic activity that might be involved in nuclear DNA metabolism. (auth)

**895** CLINICAL EVALUATION OF A RAPID METHOD FOR DETERMINATION OF FOLATE DEFICIENCY BY $^{14}$C-FORMATE INCORPORATION INTO SERINE OF LYMPHOCYTES. Soelling, H.; Ellegaard, J.; Esmann, V. (Marselisborg Hospital, Aarhus, Denmark). Scand. J. Clin. Lab. Invest.; 31: No. 4, 453-457 (Jun 1973).

A rapid modification of a previously described method for the determination of folate activity from the rate of incorporation of $^{14}$C-formate into serine of lymphocytes (the $C_1$-index) is presented. The $C_1$-index of a control group averaged 1.34 ± 0.09 (S.E.M.) nmol per 10$^9$ lymphocytes per hr (n = 16). The range of observed values, 0.94 to 2.10 nmol, is taken as the normal range. In a material of 41 patients who were not suspected of folate deficiency, the $C_1$-index was compared to other parameters of folate deficiency. A statistically significant correlation was only found between a subnormal $C_1$-index and the combined presence of an increased excretion of formiminoglutamic acid (>20 μmol/h) and a subnormal erythrocyte folate concentration (<90 ng/ml). A group of patients presenting a history of poor folate intake also had decreased $C_1$-index. (auth)

**896** FOLATE ACTIVITY OF HUMAN LYMPHOCYTES DETERMINED BY MEASUREMENT OF SERINE SYNTHESIS. Ellegaard, J.; Esmann, V. (Marselisborg Hospital, Aarhus, Denmark). Scand. J. Clin. Lab. Invest.; 31: No. 1, 9-19(Jan 1973).

A method was developed for measuring the folate activity in isolated human lymphocytes by quantitating the incorporation of $^{14}$C-formate into serine. Isotope experiments showed that serine was formed from glucose and mainly catabolized to $CO_2$, $NH_3$, and two one-carbon fragments. Ten percent of serine is incorporated into protein and 5% is converted to metabolic acids. Small amounts were metabolized to Krebs-cycle intermediates and other amino acids and also over ethanolamine and choline to glycine. Forcing the incorporation of $^{14}$C-formate into serine by adding 6.7 mmol/l glucose and 20 mmol/l glycine to the incubation medium gave in 24 experiments an incorporation of 9.2 ± 0.4% (S.E.M.) of added formate per 10$^9$ lymphocytes per 4 h. The incorporation was not influenced by added pyridoxal phosphate or tetrahydrofolic acid. The effect of added serine, homocysteine, and methionine on the formate incorporation was established in model experiments, but does not appear to be of significance for the clinical applicability of the method. In 29 experiments with lymphocytes from patients with folate deficiency, the average $^{14}$C-formate incorporation into serine was 4.4 ± 0.4% with practically no overlapping in the range of normal values. The extent of $^{14}$C-formate incorporation into methionine, RNA, and protein was also determined and found decreased in folate deficiency. The incorporated $^{14}$C-formate was recovered with 63% in free serine, 5% as protein-bound serine, 14% in methionine, and 18% in RNA. The same relative distribution of $^{14}$C-formate incorporation into the various products was found in folate deficiency states. (auth)

**897** PROBLEMS CONCERNING THYMINE DIMER ASSAY BY THE RADIOCHROMATOGRAPHIC METHOD. Masek, F.; Maskova, L.; Sedliakova, M. (Cancer Research Inst., Bratislava). Stud. Biophys.; 36-37: 43-50(1973).

From international conference on the bases of the biological effects of ultraviolet radiation; Brno, Czechoslovakia (2 Oct 1972).

The radiochromatographic method is widely used in pyrimidine dimer assay, including assay of thymine dimers (TT). Some of the problems met with when using this method are discussed, namely: 1. the influence of thymine (T) and thymidine (TdR) added to the cultivation medium after irradiation on the observed initial and actually excised amount of TT; 2. the size of fragments of excised TT after gel filtration; 3. decomposition of T by peroxides. (auth)

**898** PHENOBARBITAL SPECIFIC ANTISERA AND RADIOIMMUNOASSAY. Chung, A.; Kim, S. Y.; Cheng, L. T.; Castro, A. (United Medical Labs., Inc., Portland, OR). Experientia; 29: No. 7, 820-821(15 Jul 1973).

An antibody of high specificity to phenobarbital was developed by inoculating rabbits with a barbiturate-protein conjugate synthesized from 5-phenyl-5-(4-aminobutyl) barbituric acid and bovine serum albumin in carbodiimide. Using this antibody for radioimmunoassay it is possible to measure up to 1 picomole of phenobarbital per ml of biological fluid without significant cross reaction. (HLW)

**899** INSOLUBILIZED LACTOPEROXIDASE FOR THE [$^{125}$I] LABELLING OF PROTEINS. Kuenzle, C. C.; Doebeli, M. (Univ., Zurich). Experientia; 29: No. 7, 800-801(15 Jul 1973).

A procedure is given for the preparation of insolubilized lactoperoxidase and the labeling of antibody fragments with $^{125}$I is described. The insolubilized lactoperoxidase allowed the labeling of proteins to a high specific activity with results comparable to those reported for the soluble enzyme, but in contrast to the latter it has the advantage of rapid and effective separation from the labelled material. (HLW)

**900** $^{67}$Ga SCINTIGRAPHY IN ACUTE LEUKEMIA. Milder, M. S.; Glick, J. H.; Henderson, E. S.; Johnston, G. S. (National Cancer Inst., Bethesda, MD). Cancer; 32: No. 4, 803-808(Oct 1973).

In order to study the use of $^{67}$Ga scintigraphy in systemic malignancies, 43 whole body rectilinear scans were performed on 30 patients with acute leukemia. Results of scintigraphy were correlated with bone marrow status and evidence of infection and leukemic masses. The indications for scanning included search for occult infections, documentation of abscesses and tumor infiltrate and evaluation of bone pain. Abnormally high $^{67}$Ga activity was found in sites of leukemic involvement in untreated patients and those receiving chemotherapy. Over 80% of the patients with extensive leukemic marrow infiltration had increased bone activity, but only 27% of patients in remission had this pattern. Myeloblastomas were correctly identified in the breast, testes, and nasopharynx. Activity in these lesions also decreased after remission induction. Four patients with proven abscesses and osteomyelitis had strongly positive foci on $^{67}$Ga scans. Abscesses decreased in activity after appropriate antibiotics. Abscesses were visualized in patients with white cell counts as low as 200 per cu. mm. (auth)

**901** IMMUNOFLUORESCENT TESTS DURING THE COURSE OF DIAGNOSTIC $^{99m}$Tc USE IN ADOLESCENTS. Jeske, W.; Gajl-Peczalska, K.; Gorowski, T.; Ceranska Goszczynska, H. Pol. Arch. Med. Wewn.; 47: 479-483(1971). (In Polish).

In eighteen girls and in two boys with neutral goiter in whom scanning with $^{99m}$Tc was to be done, immunological studies were performed using a passive hemagglutination test and an indirect immunofluorescent technique. In all cases no antibodies were found before administration of the isotope. Six to fourteen weeks after irradiation, in nine patients the antibodies directed probably against the second colloid antigen (CA-2) appeared in the serum. This reaction was transient, however, because 3 to 4 months later the antibodies were not found in the sera. (auth)

**902** DETERMINATION OF MYOCARDIAL BLOOD FLOW IN MAN WITH THE USE OF THE ISOTOPE XENON-133. Dubiel, J. P.; Dubiel, J. S.; Szczeklik, J.; Horzela, T. (Inst. of Internal Disease, Krakow). Pol. Arch. Med. Wewn.; 49: 319-328(1972). (In Polish).

In 13 patients, among whom cases of mitral valve disease predominated, myocardial blood flow was determined by the technique based on selective injection of the isotope xenon-133 into the coronary artery and measurement of activity of the tracer on the surface of the chest. In eight persons, after injection of the tracer into the left coronary artery blood flow was 50.2 to 77.4 ml/100 g/min (x = 62.2 ± 8.85). In five persons in whom xenon-133 was injected into the right coronary artery, the values ranged between 30.4 and 82.8 (x = 56.4 ± 18.2). The results are similar to those obtained by other authors in healthy persons and in patients with coronary atherosclerosis. The advantages and disadvantages of the method are discussed on the basis of the observations and the literature. (auth)

**903** STUDIES ON HYPERCOAGULABILITY STATE IN CERTAIN RENAL DISEASES USING FIBRINOGEN LABELED WITH $^{131}$I. Filipowicz, Z.; Kardasiewicz, W.; Czarniecki, W.; Schreyer, K.; Golebiowski, S. (Clinic of Internal Diseases, Warsaw). Pol. Arch. Med. Wewn.; 49: 13-23(1972). (In Polish).

Determining the half-time of radioactivity decay of fibrinogen (T½ $^{131}$I fibrinogen) was used to try to answer the question whether various renal diseases are associated with a tendency for formation of intravascular blood clots. In analysis of the results, the renal efficiency and the dynamics of the disease were taken into account among other factors. Investigations were carried out in 13 controls and in 21 patients with renal diseases including 8 patients without and 13 with renal failure and a statistically significant reduction in the half-time of radioactivity decay was observed, which together with the results of studies on thromboelastographic investigations support the hypothesis of increased clotting tendency in patients with renal diseases. (auth)

**904** VALUE OF RADIOIMMUNOLOGICAL ASSAY OF INSULIN IN DIFFERENTIAL DIAGNOSIS OF HYPOGLYCEMIA. Gembicki, M.; Kosowicz, J.; Sobieszczyk, S.; Porawska, J. (Inst. of Internal Diseases, Poznan, Poland). Pol. Tyg. Lek.; 27: 1031-1034(1972). (In Polish).

Results of investigations of serum insulin level in hypoglycemia due to islet cell tumors, liver carcinoma, and in functional hypoglycemia are described. Serum insulin level was determined in fasting patients, during hypoglycemia, and after intravenous injection of tolbutamide. Radioimmunoassay of insulin with the technique of double antibodies was used. In three cases of pancreatic tumors, the serum insulin level was raised during attacks of hypoglycemia, injection of tolbutamide was followed by a further rise of this level. The insulin content in surgically removed pancreatic tumors was very high. (auth)

905 LIQUID SCINTILLATION COUNTING IN NUCLEAR MEDICINE. Bransome, E. D. Jr. (Medical Coll., Augusta, GA). Semin. Nucl. Med.; 3: No. 4, 389-399(Oct 1973).

Many of the radionuclides used in nuclear medicine can be measured by liquid scintillation (LS) counting, and the technique is the only practical approach to counting low-energy $\beta$ emissions. The capabilities of LS counting and of some precautions that should be observed are reviewed. Because most scintillation solvents will tolerate only minimal amounts of aqueous samples of the sort usually of interest in nuclear medicine, oxygen flask combustion (for $^{14}$C or $^{3}$H), hydrolysis, addition of surfactants (solubilizers), or thixotropic gels, all relatively expensive procedures, may have to be used for sample preparation. The cost of sample preparation is frequently the only significant unfavorable feature of LS counting when compared to gamma (NaI-crystal) scintillation counting. (auth)

906 WHOLE-BODY COUNTING. Andrews, G. A.; Gibbs, W. D.; Morris, A. C. Jr.; Ross, D. A. (Oak Ridge Associated Universities, TN). Semin. Nucl. Med.; 3: No. 4, 367-388(Oct 1973).

Whole-body counting has been directed toward two uses, one having to do with the detection and measurement of minute amounts of natural or accidentally acquired radioactivity, the other being concerned with absorption and retention of radionuclides administered for diagnostic or therapeutic purposes. In the past, the radiation safety applications have tended to overshadow the nuclear medical uses, and instruments have been designed mostly for the former. In the future, with the design of more versatile instruments and with the anticipated use of lower doses of nuclides for diagnostic purposes, the two applications will probably tend to come closer together, and many instruments will be used for both. A variety of improvements in instrument design and in handling of data have produced greater accuracy in results. Methods of measuring organ distribution and procedures for quantitative imaging are now employed, along with whole-body counting. Thus whole-body counting, at least in its clinical applications, may become less of a distinct and separate procedure than it has been in the past. Increased uses for these procedures are foreseen in radiation safety, nuclear medicine, and biomedical research. (auth)

907 QUANTIFICATION OF THE RADIONUCLIDE IMAGE. Brown, D. W.; Kirch, D. L.; Trow, R. S.; LeFree, M.; Steele, P. P. (Veterans Administration Hospital, Denver). Semin. Nucl. Med.; 3: No. 4, 311-325(Oct 1973).

The clinical value of radionuclide images can be increased by using quantification. The earliest radionuclide images were digital or quantitative in nature, but they were soon replaced by analog photoscans. Now, with the introduction of computers, quantitative digital scanning is again becoming widely used. Interfacing either rectilinear scanners or Anger-type scintillation cameras to a computer is no longer a difficult problem. Relatively low costs, insignificant dead times, and dependability are easy to achieve. The selection of an appropriate sampling interval is an important problem in quantitative scanning. If the interval is too large, resolution is degraded; if it is too small, costs increase rapidly, and counts recorded during each interval become so small that they lack statistical validity. This is true for both spatial (the static image) and temporal (dynamic function) analysis. Using sampling theory, a basis for interval selection is developed. With an Anger-type scintillation camera, a 128 × 128 recording results in negligible degradation of resolution, a 64 × 64 array introduces detectable but acceptable loss, and a 32 × 32 array results in serious loss. A computer-camera system was designed for maximum flexibility and ease of use by the clinician and technician. New developments for this system allow display in different shades of gray with variable contrast, selective intensification of levels or regions of interest, framing rates of 20/sec, input of remote analog signals via telephone, resolution enhancement, and a sophisticated curve-analysis program with functions such as curve fitting, integration, differentiation, Fourier transformation, and deconvolution. Resolution enhancement of static images is carried out in the frequency domain through a new adaptive method of filtering and deconvolution with empirically selected logarithmic functions. Use of the system for dynamic studies is illustrated by radionuclide angiocardiography. Ventricular end systolic and diastolic volume, ejection fractions, and forward and backward (regurgitant) stroke volumes through all four cardiac valves can be determined quantitatively. Computed radioisotopic end diastolic volumes and ejection fractions correlate well with similar measurements determined by left cine ventriculography. (auth)

908 ROLE OF COMPUTERS IN NUCLEAR MEDICINE LABORATORIES. Glass, H. I. (Hammersmith Hospital, London). Semin. Nucl. Med.; 3: No. 4, 303-310(Oct 1973).

There are several methods of using computers in nuclear medicine laboratories. These include the use of special-purpose computers on individual apparatus, linking of apparatus to a central computer, or the processing of all data off-line on a batch-processing computer. The range of applications of computers in nuclear medicine is examined, and a suggestion concerning the minimum specification of a centralized nuclear medicine system is proposed. There would appear to be little advantage to be gained at the present time by introducing into nuclear medicine departments computers that will not permit expansion in the future to this minimum proposed specification. (auth)

909 SEMICONDUCTOR DETECTOR SYSTEMS. Ter-Pogossian, M. M.; Phelps, M. E. (Washington Univ., St. Louis). Semin. Nucl. Med.; 3: No. 4, 343-365(Oct 1973).

The growing interest in the possible applications of semiconductor radiation detectors in nuclear medicine stems mostly from two features of these devices: high radiation energy resolution and small physical dimensions. Many of these applications utilize semiconductors in place of scintillation detectors in scintiscanners or gamma cameras; others allow techniques heretofore impractical or impossible, such as the tracing of high-atomic-number indicators by stimulating and detecting their characteristic x rays or by the selective absorption of x rays traversing the structures opacified by such indicators. Small semiconductor detectors are well suited for use as probes in the immediate vicinity of anatomical structures. In in-vitro studies, semiconductor detectors are unexcelled in a number of elemental analysis methods, as well as for the assay of radiochemical purity of radiopharmaceuticals. (auth)

# MATERIALS

**910** (AECL-4517) MATERIALS RESEARCH IN ATOMIC ENERGY OF CANADA LIMITED. (Atomic Energy of Canada Ltd., Chalk River (Ontario)). Summer 1973. 25p. Dep. NTIS (U. S. Sales Only) $3.25. AECL $1.00.

This review covers the electron microscopy of ceramic materials (ion milling and radioinduced defects in SiC); computer analysis of transmission electron diffraction ($ZrO_2$); diffusion, phase formation, and bonding of soft Ni to hard Ti; hydriding of zirconium/steel rolled joints; nondestructive testing of nuclear fuel; and contact stresses, deformation, and wear (of oxidized Zr and Zircaloy-2 in water). (DLC)

**911** (COO-3342-2) LOW-TEMPERATURE AND NEUTRON PHYSICS STUDIES. Progress Report, August 1, 1972–August 31, 1973. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Physics). 31 Aug 1973. Contract AT(11-1)-3342. 5p. Dep. NTIS $3.00.

Results are summarized briefly for studies of the diamagnetic scattering of neutrons by Bi, nuclear polarization of $^7Li$, the low-temperature transformation in $ZrV_2$, dynamic diffraction in perfect Cu crystals, and neutron flight-time transmission in pyrolytic graphite. These results either are preliminary or have already been published. (7 references) (DLC)

**912** SOME APPLICATIONS OF MOESSBAUER EFFECT IN SOLID STATE PHYSICS. Bhide, V. G. (National Physical Lab., New Delhi). J. Sci. Ind. Res.; 30: No. 4, 160-175(Apr 1971).

The phenomenon of Moessbauer effect or recoilless emission of gamma rays in bound lattices is explained briefly. The extremely narrow linewidth of the gamma ray which can be measured and the property of zero-phonon emission have made this effect a very valuable tool for measurements in solid-state physics. It has been possible to measure a variety of hyperfine interactions such as (1) the electric monopole interaction between the positively charged nucleus and the effective "s" electron density at the nucleus; (2) electric quadrupole interaction between the quadrupole moment of the nucleus and the electric field gradient at the nucleus arising out of the asymmetric charge distribution on the ion itself and/or in the crystal lattice; and (3) magnetic dipole interaction between the magnetic moment of the nucleus and the hyperfine field at the nucleus. Moessbauer effect has been applied to the study of the piezoelectric and pyroelectric properties of ferro and antiferro-electrics. Moessbauer spectra of a few typical ferroelectrics are discussed. Variations in the spectra with temperature are studied. Solid state reactions in MgO:FeO system and collective electron transitions in $LaCoO_3$ and other cobaltates have also been investigated using the Moessbauer effect. (INIS)

**913** MECHANICAL BEHAVIOR OF MATERIALS. Proceedings of the International Conference, Kyoto, Japan, August 15-20, 1971. Special volume. Kyoto; Society of Materials Science (1972). 244p. (CONF-710851-SP).

Four lectures are included in this volume: new directions in materials research dictated by stringent future requirements, properties of nonmetallic materials, mechanical behavior of metals, and the x-ray approach to the study of mechanical behavior of metals. The topics discussed by the contributed papers in each of the ten sessions are summarized; the papers and participants are also listed. (DLC)

## Ceramics and Cermets

*Refer also to abstracts 946, 951, 957, 2006, 2008–2010, 2019, 2392, 2399, and 2401.*

**914** (GEAP-12418) THERMODYNAMIC DATA PROGRAM INVOLVING PLUTONIA AND URANIA AT HIGH TEMPERATURES. Quarterly Report No. 23, February 1–April 30, 1973. Aitken, E. A.; Adamson, M. G.; Dutina, D.; Evans, S. K.; Ludlow, T. E. (General Electric Co., Pleasanton, Calif. Vallecitos Nuclear Center). May 1973. Contract AT(04-3)-893. 23p. Dep. NTIS $4.00.

Progress is reported on the continuing scope of work related to fission-product–cladding interaction, sodium–fuel chemical interactions, and O:M and Pu:U redistribution. In addition, an analysis and experimental study is presented on the use of oxygen absorbers inside an LMFBR fuel pin to maintain a low oxygen activity and thereby decrease the chance for cladding attack. (auth)

**915** (GULF-GA-A-12632) FUEL KERNEL MATERIALS FOR THE THORIUM CYCLE HTGR. Stansfield, O. M.; Gulden, T. D.; Harmon, D. P. (Gulf General Atomic Co., San Diego, Calif. (USA)). 29 Jun 1973. Contract AT(04-3)-167. 17p. (CONF-731004-2). Dep. NTIS $3.00.

From international conference on nuclear fuel performance; London, UK (15 Oct 1973).

The thorium cycle HTGR typically employs fissile particles containing fully enriched uranium and fertile particles containing thorium. Small fuel kernels (~$10^{-4}$ $cm^3$ in volume) are separated by coating layers and matrix material so that the mechanical and thermal properties of the fuel body are, to a large extent, independent of the fuel kernel properties. This feature gives rise to an advantageous flexibility in kernel selection. Both dioxide and dicarbide kernels of Th and U and solutions of the two have been developed. During irradiation carbide and oxide kernels undergo swelling and accumulate a significant fission product inventory. Interaction between the kernel and outer structural coatings is prevented by an intervening low-density buffer layer. Kernel migration into the coating up the thermal gradient is exhibited by both carbides and oxides. A limitation of coating penetration due to kernel migration in carbide fuels forms the basis for core thermal design. Thorium oxide is the most stable kernel material with little propensity for migration relative to other oxides and the carbides. Mixed oxide fuels have been favored in European HTR design. In the United States where a segregated thorium cycle is employed, fissile $UC_2$ and fertile $ThO_2$ kernels have been selected for HTGR fuel based on optimization of performance and predictability under operating conditions. (auth)

**916** (KFK-1736) $UO_2$–$PuO_2$ FUEL-ROD-BUNDLE IRRADIATION MOL-7A. Evaluation of the Investigation Results on the Irradiated Fuel Rods. Dienst, W.; Ehrlich, K.; Goetzmann, O.; Hoffmann, H.; Kleykamp, H.; Schaefer, L.; Schulz, B.; Zimmermann, H. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Jun 1973. 135p. (In German). Dep. NTIS (U. S. Sales Only) $8.75.

Seven $UO_2$–20% $PuO_2$ fuel rods (500-mm fuel length) were irradiated in a fuel rod bundle cooled by flowing sodium. Irradiation was performed in the epithermal neutron flux of the test reactor BR 2 (Mol) at rod powers between about 300 W/cm (fuel end) and 560 W/cm (neutron flux maximum) to a maximum burnup of about 45 MWd/kg (U+Pu). The maximum fuel center temperature was calculated to be about 2800°C in the beginning, and about 2000°C for the largest part of irradiation time. The maximum cladding internal temperature (at the hot rod ends) was between 570 and 620°C. The post-irradiation volume distribution in fuel rod cross-sections was investigated along with fission product composition and quantity, Pu redistribution, U redistribution chemical reactions between the fuel and stainless steel cladding, and mechanical properties. (15 figures, 88 references) (JRD)

**917** (KFK-1824) DEVELOPMENT AND PERFORMANCE OF A THERMAL CONDUCTIVITY CELL FOR THE MEASUREMENT OF $UF_6$-CONTENT IN THE PROCESS GAS OF A SEPARATION NOZZLE PLANT. Plesch, D.; Schuette, R. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Kernverfahrenstechnik). Aug 1973. 33p. (In German). Dep. NTIS (U. S. Sales Only) $3.75.

Thesis. Submitted by D. Plesch to Technische Hochschule, Karlsruhe (West Germany).

Essentially, adjustment and supervision of a separation nozzle cascade for the enrichment of uranium-235 is accomplished with the aid of the pressures and $UF_6$ concentrations of the mixture consisting of uranium hexafluoride and a light additional gas applied as process gas. For continuous measurement of the $UF_6$ content in the 10-stage separation nozzle pilot plant working with a mixture of 5 mol% $UF_6$ and 95 mol% He at absolute pressures of about 40 torr, a concentration measuring cell was developed, based on the thermal conductivity method. As a result of the suitable design of the heater element in the cell (Knudsen number 0.002 at 40 torr He), a sufficiently small pressure dependence of the concentration reading (corresponding to 0.008 mol% $UF_6$/torr) with a detection limit of 0.01 mol% $UF_6$ in He could be obtained. It was confirmed experimentally that a noticeable influence of thermal diffusion on the concentration measurement does not occur under the operation conditions of the plant. The thermal conductivity cells mounted at the different stages of the pilot plant are connected with a common electrical supply and thermostat circuit and calibrated together. Compared with the use of autonomous instruments, this does not only reduce the expenditure of the equipment, but also improves the measuring cells' relative accuracy which is important for the adjustment of the cascade. An adjustment experiment is briefly reported, the evaluation of which gives a maximum relative error of ±0.3% of the concentration reading, corresponding to ± 0.015 mol% $UF_6$. (auth)

918 (KFK-1839) OXIDE-CERMET FUEL RODS: PRODUCTION, PROPERTIES, AND IRRADIATION BEHAVIOR. Weimar, P.; Zimmermann, H. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Aug 1973. 51p. (In German). Dep. NTIS (U. S. Sales Only) $4.75.

Oxide—cermet fuel pins with idealized fuel structure and metallurgically bonded cladding have some properties which cannot be obtained by pins with oxide pellets. The continuous metal network in the fuel provides a considerably larger thermal conductivity and a lower central temperature during irradiation. The lower central temperature and the metallic envelopment of the fissionable oxide particles decrease or prevent the release of fission gases and volatile fission products. Therefore, the absence of a gas plenum is characteristic of cermet pins. For use in fast reactors only Cr and V are potential matrix metals because of their low cross sections for fast neutrons. The cermets with idealized structure were produced by metallizing $UO_2$ spheres with Cr, V, or Mo by a vapor-deposition process. The spheres are vibrated into the cladding tubes, for instance in Inconel 625 or Hastelloy X tubes in the case of $UO_2$—Cr cermets. After electron beam welding of the tubes the pins are isostatically hot-pressed in He atmosphere. The metal content of the cermets was 20 and 30%, respectively. Some properties of the $UO_2$—Cr, $UO_2$—V, and $UO_2$—Mo cermets are described. Seven irradiation capsules, one with $UO_2$—Mo, four with $UO_2$—Cr, and two with $UO_2$—V samples, were irradiated in the FR 2 reactor at mean rod powers of 470 to 700 W/cm and mean cladding temperatures of about 600°C to 10 to 95 MWd/kg U burnup. Each of the capsules contained eight or four fuel rod samples. $UO_2$— 30 vol.% Cr cermets with Inconel 625 cladding were irradiated to 60 and 95 MWd/kg U burnup without showing any failure. At these burnups the Hastelloy X claddings were probably damaged by microcracks. However, the temperatures of the Hastelloy X claddings were nearly 100°C higher than those of the Inconel 625 claddings. The high burnup $UO_2$—Cr samples with Inconel 625 or Hastelloy X cladding did not show dimensional changes in any case. The samples with 20% Cr showed a depletion of Cr in the fuel central region. Cr had been evaporated and condensed in the outer regions of the fuel. No such depletion was found in the cermet fuel with 30% Cr. The vanadium claddings of the $UO_2$—V cermets were damaged by many cracks in consequence of oxygen embrittlement during irradiation. It is suggested that $UO_2$—30% Cr fuel pins can be operated with linear rod powers of about 800 W/cm and cladding temperatures of 650°C to burnups of 60 MWd/kg U and probably more. A further increase of the rod power can be achieved only with a matrix metal heaving a lower vapor pressure. (auth)

919 (KFK-EXT-6/73-1) COMPARISON OF MEASUREMENTS ON THE INFLUENCE OF CALCINATION PRETREATMENT ON THE SPECIFIC AREA OF $UO_2$ POWDERS. Guenther, E.; Dascalu, D. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Material- und Festkoerperforschung). Apr 1973. 32p. (In German). Dep. NTIS (U. S. Sales Only) $3.75.

A controlled alteration in the specific surface area of $UO_2$ can be arrived at by thermal pretreatment. The effect is achieved by calcinating the powder either at a constant temperature for different times or at different temperatures for a constant period. Additionally, the area can be altered by introduction of reducing gas mixtures of differing purity and quantity. The apparatus employed for the determination of the specific surface area provide reproducible results which, however, differ by a definite amount in the range investigated. (auth)

920 (LA-5390-PR) ADVANCED PLUTONIUM FUELS PROGRAM. Quarterly Report, April 1—June 30, 1973 and Seventh Annual Report, FY 1973. Baker, R. D. (Comp.). (Los Alamos Scientific Lab., N. Mex.). Sep 1973. Contract W-7405-eng-36. 41p. Dep. NTIS $4.00.

Research and development progress is reported on radiation effects on LMFBR fuels, overall evaluation of LMFBR fuels, and analytical standards for fast breeder reactor fuels. (JRD)

921 (LA-UR-73-804) HIGH TEMPERATURE-LOW DENSITY ZrC INSULATORS MADE BY CHEMICAL VAPOR DEPOSITION. Driesner, A. R.; Storms, E. K.; Wagner, P.; Wallace, T. C. (Los Alamos Scientific Lab., N. Mex. (USA)). 1973. Contract W-7405-eng-36. 17p. (CONF-731017-2). Dep. NTIS $3.00.

From fourth international conference on chemical deposition vapor; Boston, Massachusetts, USA (7 Oct 1973).

Development is described of porous ZrC as an insulator for high-temperature, gas-cooled reactors. $ZrC_x$ is a stable, single-phase carbide in the region $0.98 \geq \times \geq 0.59$. The thermal conductivity of $ZrC_x$ is very sensitive to the vacancy concentration in the carbon sublattice (i.e., 1-x). To decrease the value of the thermal conductivity of $ZrC_x$ sufficiently to make the insulator, the carbon—zirconium ratio was decreased to an optimum value and the thermal conductivity decreased further by introduction of porosity in the $ZrC_x$ matrix. By these techniques, the thermal conductivity of $ZrC_x$ at 300°K was decreased from 50 W $m^{-1}K^{-1}$ to less than 1 W $m^{-1}K^{-1}$. $ZrC_x$ of 65 to 85% porosities were investigated and their properties measured. The production material was a 70% porous, fiber-based $ZrC_x$ which had satisfactory strength, thermal stress resistance, insulating power, and uniformity. Details are given of the fabrication and evaluation of the porous $ZrC_x$ which was made for the Rover reactor applications. (12 figures, 3 tables) (auth)

922 (ORNL-TM-4094) IMPROVED SIZE UNIFORMITY OF SOL—GEL SPHERES BY IMPOSING A VIBRATION ON THE SOL IN DISPERSION NOZZLES. Haas, P. A.; Lackey, W. J. (Oak Ridge National Lab., Tenn. (USA)). May 1973. Contract W-7405-eng-26. 55p. Dep. NTIS $4.75.

A major part of the Th—$^{233}$U fuel cycle program at ORNL has been concerned with the development of sol-gel processes to prepare $ThO_2$ and $ThO_2$—$^{233}UO_2$ spheres. The formation of sol drops having a uniform and controlled diameter is important to any sol-gel process for preparing oxide kernels for High Temperature Gas-Cooled Reactor fuels. A recently developed technique that incorporates use of a sol disperser with vibration has met the dispersion requirements for ORNL sol-gel processes better than any of the previous techniques employing dispersers alone. With this new technique, the breakup of sol streams from orifices or capillaries is made more uniform and regular by imposing a vibration, at the natural frequency of drop formation, on the sol at the entrance to the orifices or capillaries. This technique has been applied to two-fluid nozzles to form 1,000 to 88,000 sol drops per minute. Batches consisting of 1 to 13 kg of fired $ThO_2$ spheres 370 to 500 $\mu$ in diameter had average diameters within 1% of the predicted values and standard deviations of 2.5 to 5.0 $\mu$. Yields after both size and shape separation were greater than 95% and were usually greater than 98% in a 30-$\mu$ range. The same technique was applied to shear nozzles at rates up to 192,000 drops per minute. Nozzles of this type use multiple orifices and are more dependable for larger capacities than multiple two-fluid nozzles. (auth)

923 X-RAY-DIFFRACTION STUDY OF FILMS BASED ON TIN AND INDIUM OXIDES. Hecq, M.; Dubois, A.; Van Cakenberghe, J. (Univ., Mons, Belgium). Thin Solid Films; 18: No. 1, 117-125(Oct 1973). (In French).

Thin films of $In_2O_3$:Sn have been produced by an induced discharge in a cavity made with a mixture of $In_2O_3$ and $SnO_2$. The growth of these films on glass substrates has been studied at two temperatures. The fine structure of the x-ray diffractogram indicates that tin is deposited as SnO. Annealing in air at 400°C increases the resistivity when the film is crystalline and decreases it when the film is amorphous. (auth)

924 DETERMINATION OF THE BONDING ENERGY OF SURFACE OXYGEN IN OXIDES FROM THE TEMPERATURE VARIATION OF THE EQUILIBRIUM OXYGEN PRESSURE. Mishchenko, Yu. A.; Gol'dshtein, N. D.; Gel'bshtein, A. I. (Physical Chemistry Inst., Moscow). Russ. J. Phys. Chem. (Engl. Transl.); 47: No. 3, 292-294(Mar 1973).

Translated from Zh. Fiz. Khim.; 47: No. 3, 511-514(Mar 1973).

The possibility of determining the bonding energy of surface oxygen from the fugacity of oxygen over the oxide was considered in relation to vanadium pentoxide and molybdenum trioxide. The oxygen bonding energies in the $-V=O$ surface groups and in the $-V-O-V-$ linkages, forming curved layers in the $V_2O_5$ lattice, have been determined as examples. A linear increase of the oxygen bonding energy in the $-V-O-V-$ linkages with decrease of the concentration of oxygen in the curved layers has been established. The evolution of molecular oxygen from $MoO_3$ in the temperature range investigated (up to 580°C) has not been observed. (auth)

925 CALCULATION OF EQUILIBRIUM DIAGRAM FOR SCANDIUM(III) OXIDE—MAGNESIUM OXIDE SYSTEM BY MEANS OF THEORY OF REGULAR SOLUTIONS. Lopato, L. M.; Ogorodnikov, V. V.; Ogorodnikova, A. A. (Inst. of Problems of Materials Behaviour, Kiev). Russ. J. Phys. Chem. (Engl. Transl.); 47: No. 3, 352-354(Mar 1973).

Translated from Zh. Fiz. Khim.; 47: No. 3, 625-628(Mar 1973).

Phase equilibrium lines for the $Sc_2O_3$—MgO system are calculated theoretically to the approximation of regular solutions by means of Pines' equations. Two procedures are used—from data for the pure components (a priori calculation), and with the use of a limited number of experimental data (for two temperature cross-sections of the experimental equilibrium diagram). (auth)

**926** $^2S_{½}$ STATE IONS IN INORGANIC LUMINESCENT MATERIALS. Born, G.; Hofstaetter, A.; Scharmann, A. (Univ., Giessen, Ger.). J. Lumin.; 6: No. 5, 376-384(Aug 1973).

Selected examples of impurity ions with one unpaired electron in an unfilled shell are $Pb^{3+}$ ions in II to VI compounds (ZnO, ZnSe, ZnTe), $Pb^{3+}$ in $CaWO_4$, F centers in alkali metal halides, and $Ag^0$ and $Au^0$ atoms in radiophotoluminescent (RPL) glasses. Comparative studies of EPR, luminescence, thermoluminescence, and related phenomena were performed on systems with $^2S_{½}$ state ions as central ions and systematically varying ligand ions in the temperature range from 1.6 to 450°K. Luminescence bands attributed to internal transitions $^2P_{½,½} \rightarrow {}^2S_{½}$ ground state are reported especially with respect to the corresponding EPR data. All data are summarized in a molecular orbital model for the luminescence complex. (2 tables, 4 figures, 23 references) (auth)

**927** RADIATSIONNO-STIMULIROVANNAYA ADSORBTSIYA. (Radiation-Stimulated Adsorption). Ermatov, S. E. Alma-Ata, USSR; Izdatel'stvo Nauka Kazakhskoi SSR (1973). 224p.

Data are reported on changes in surface properties of oxide dielectrics and semiconductors caused by the action of ultraviolet radiation; slow electrons of a low-temperature plasma; x, gamma, and beta irradiations; and currents of neutrons, protons, and alpha particles relative to some gases and liquids. Also, discussions are presented on the nature of active centers and the adsorption mechanism of single-and multi-atom gases on the surface of silicon dioxide during excitation by neutral radiation and charged particles (tr-auth)

**928** SELF-RADIATION DAMAGE INGROWTH IN $^{238}PuO_2$. Chikalla, T. D.; Turcotte, R. P. (Battelle Pacific Northwest Labs., Richland, WA). Radiat. Eff.; 19: No. 2, 93-98(Jun 1973).

Self-irradiation lattice damage due to alpha particle and $^{234}U$ recoil atom bombardment has been studied in $^{238}PuO_2$ by x-ray diffraction. In a well-annealed sample, the room temperature damage ingrowth follows a simple exponential function to the saturation damage level. In incompletely annealed samples, the damage ingrowth curve is discontinuous and exhibits a maximum. This is believed to result from the migration of point defects to residual sinks. (auth)

**929** ANNEALING OF SELF-RADIATION DAMAGE IN $^{238}PuO_2$. Turcotte, R. P.; Chikalla, T. D. (Battelle Pacific Northwest Labs., Richland, WA). Radiat. Eff.; 19: No. 2, 99-108 (Jun 1973).

The annealing of self-radiation lattice damage in $^{238}PuO_2$ was studied by x-ray diffraction in samples that have reached a saturation damage level. Isothermal and isochronal anneals were used to define the recovery behavior to 1200° C. The annealing is complex and consists of a very rapid first stage due to interstitial-vacancy annihilation followed by more complicated recovery processes. The activation energy for Stage I recovery is 4 kcal. The isochronal annealing curves are strongly dependent on the residual helium concentration. (auth)

**930** ENDOR INVESTIGATION OF THE $F^+$ CENTRE IN $Mg^{17}O$. Allsop, A. L.; Owen, J.; Hughes, A. E. (Oxford Univ.). J. Phys., C (London); 6: No. 17, L337-L339(4 Sep 1973).

ESR and ENDOR were used to investigate the $F^+$ centre produced by neutron irradiation in MgO crystals enriched in the isotope $^{17}O$. A study was made of the hyperfine interactions between the trapped electron and $^{17}O$ nuclei at the first four anion shells neighbouring the oxygen vacancy. The results are consistent with a wave function in which most of the unpaired spin is in 2p orbitals on the twelve nearest $O^{2-}$ ions with smaller admixtures of 3x and 3p orbitals on the six nearest $Mg^{2+}$ ions. There is also evidence for small 2p admixtures at further $O^{2-}$ sites. (auth)

**931** PREPARATION AND CHARACTERIZATION OF THE METASTABLE MONOXIDES OF THORIUM AND URANIUM. Ackerman, R. J.; Rauh, E. G. (Argonne National Lab., IL). J. Inorg. Nucl. Chem.; 33: No. 11, 3787-3794(Nov 1973).

The solid monoxides of thorium and uranium were obtained by thermal decomposition of previously reported compounds in which the lower valence states (< + 4) of the metals are stabilized by HCl and $H_2O$. The respective monoxides were characterized by x-ray diffraction and yield lattice constants of 5.302 ± 0.003 Å for ThO(s) and 5.00 ± 0.01 Å for UO(s). Both monoxides are shown to be thermodynamically unstable via disproportionation to the respective metals and dioxides. The molar volumes of these and higher actinide monoxides lie between those of the respective metals and dioxides and the calculated cationic radii are significantly larger than those in the monosulfides and the dioxides. Volatile chlorides including $ThCl_4$(g), $UCl_4$(g), and $UCl_3$(g) were observed mass-spectrometrically to vaporize during thermal decomposition. Ionization potentials of 12.7 ± 0.3, 11.0 ± 0.3, and 10.0 ± 0.5 eV respectively, were measured. (auth)

**932** COVALENT BOROHYDRIDES. Semenenko, K. N.; Kravchenko, O. V.; Polyskova, V. B. (Moscow State Univ.). Usp. Khim.; 42: No. 1, 3-25(Jan 1973). (In Russian).

The properties, structure, and methods of determining the borohydrides of beryllium and some heavy metals—Zr, Hf, Th, and U—are discussed. These compounds, which may be grouped as the so-called "covalent complex" borohydrides, have many common properties, such as physical properties, high reaction capabilities, nature of their chemical bonds, and type of chemical conversions in which molecules of the type $M(BH_4)n$ are formed. The basic types of chemical reactions that occur with covalent borohydrides, principles of molecular and crystal structure, and the possibility of using covalent borohydrides in various inorganic syntheses are examined. (tr-auth)

**933** ELECTRON-MICROSCOPIC OBSERVATIONS OF THE ORDERED DEFECTS IN MONOCLINIC $ReO_2$ IN THE STRUCTURAL TRANSFORMATION $Re_2O_5 \rightarrow ReO_2$. Colaitis, D.; Lebas, D.; Lecaille, C. (Laboratoire de Chimie des Solides, Paris). Mater. Res. Bull.; 8: No. 10, 1153-1164(Oct 1973). (In French).

The formation of monoclinic $ReO_2$ from $Re_2O_5$ disproportionation is studied by means of transmission electron microscopy and diffraction. Single crystals of monoclinic oxide can be characterized as polygonal plates compatible with the space group $P2_1/c$. A possible structural mechanism is described, involving the formation of cation vacancies and their regular arrangement, according to planar-ordered faults observed on patterns. (auth)

**934** CRYSTAL GROWTH AND PRECISION LATTICE CONSTANTS OF SOME $Ln_2(WO_4)_3$-TYPE RARE EARTH TUNGSTATES. Brixner, L. H.; Sleight, A. W. (E. I. du Pont de Nemours and Co., Wilmington, DE). Mater. Res. Bull.; 8: No. 10, 1269-1274 (Oct 1973).

Single crystals of the title compounds with Ln = La, Ce, Pr, Nd, Sm, and Eu have been grown by the Czochralski technique, and their cell parameters and melting points were determined accurately. All compounds crystallize in the prototype C2/c symmetry, and apparently only $La_2(WO_4)_3$ exhibits a phase transition between room temperature and the melting point. Cell volumes vary linearly with (ionic radius)$^3$. (auth)

**935** KOSSEL MICRODIFFRACTION STUDIES OF $TaO_z$. Harris, N.; Taylor, A.; Stringer, J. (Univ. of Liverpool). Acta Met.; 21: No. 12, 1677-1683(Dec 1973).

The orientation relationships between the tantalum metal matrix and platelets of the metastable suboxide $TaO_z$ formed during oxidation at 950°C in oxygen at 10 torr pressure were studied using Kossel microdiffraction. The suboxide appears to have cubic symmetry (as opposed to the tetragonal structure suggested by earlier investigators) and satisfies the Bain relationship with the matrix: $[001]_{Ta} \| [011]_{TaO_z}$, $[100]_{Ta} \| [100]_{TaO_z}$, and $[010]_{Ta} \| [0\bar{1}1]_{TaO_z}$. The lattice parameter is 4.76 Å. On the basis of the observed orientation relationship and the intensities of the reflections it is tentatively suggested that the structure is essentially face centered cubic, and it is shown that it is possible to index the data in the literature on the basis of this lattice. The optical anisotropy of the suboxide and the appearance of faint reflections forbidden for fcc is attributed to ordering of vacancies on the oxygen lattice by analogy with transition metal carbides. The composition of the platelets has been determined by the technique of absorbed electron current measurement as $0.88 < z < 1.15$; and on structural grounds it appears that $z < 1.0$. The tantalum atom density in the suboxide agrees with that estimated from morphological aspects of the oxidation of tantalum. (auth)

**936** INFLUENCE OF DEVIATIONS FROM STOICHIOMETRIC COMPOSITION ON THE DIFFUSIONAL CREEP OF URANIUM DIOXIDE. Burton, B.; Reynolds, G. L. (Central Electricity Generating Board, Berkley, Eng.). Acta Met.; 21: No. 12, 1641-1647(Dec 1973).

The diffusional creep behavior of uranium dioxide was investigated as a function of deviation from stoichiometric composition. Creep is shown to be influenced by two factors that vary independently with O/U ratio. First, the interfacial processes that limit diffusional creep in stoichiometric material become progressively less important with increasing O/U, and second, creep is influenced by the change in diffusivity with O/U. The relative importance of these two factors is assessed in different ranges and their implications are discussed. At large O/U ratios the phase $U_3O_8$ is stable and the presence of this phase is shown to lead to a suppression of creep; this aspect is investigated. (auth)

**937** CERAMIC WITH ZIRCONIUM OXIDE BASE. Rummel, W. (to Siemens AG). German Patent 1,671,026. 29 Oct 1970.

Filed date 13 Apr 1966. (In German).

A ceramic with a zirconium oxide base is described that is stable at high temperatures and contains from 10 to 60 mol % $ZrB_2$, ZrD, or ZrN. (TSS)

**938** DRY TREATMENT OF GRANULATED NUCLEAR FUEL. Pirk, H.; Roepenack, H.; Goeldner, U. (to Nuklear Chemie Metallurgie mbH). German Patent 1,901,784. 17 Sep 1970. Filed date 15 Jan 1969. (In German).

A process is described for the dry treatment of granulated nuclear fuel with a ceramic base of uranium oxide characterized by the fact that the uranium oxide powder produced is sifted. (TSS)

**939** DEVICE FOR MELTING OF OXIDES, e.g., $UO_2$ OR $PuO_2$ OR OF A MIXTURE OF THE TWO OXIDES. Teiwes, H. J. (to Nuklear Chemie und Metallurgie). German Patent 1,758,299. 4 Mar 1971. Filed date 9 May 1968. (In German).

A device is described that is characterized by the fact that the bottom of the crucible with the residue from melting and the powdered material remaining can be lowered into the chamber where the residue and the powder can be removed from the crucible. (TSS)

**940** METAL–CERAMIC MIXTURE. Thuemmeler, F. (to Gesellschaft Kernforschung mbH). German Patent 1,813,582. 1 Oct 1970. Filed date 10 Dec 1968. (In German).

The metal–ceramic mixture described has high static and dynamic resistance and a metal content of 20 to 40% by volume in the directions corresponding to three dimensions in which the density of the metallic constituents is between 95 and 100% of the theoretical density. This mixture is used as fuel or fertile material for a nuclear reactor. The density of the ceramic fraction of the nuclear fuel is less than 100%, preferably comprising between 80 and 90% of the theoretical density. (TSS)

**941** SPONTANEOUS POLARIZATION OF $Gd_2(MoO_4)_3$. Sawaguchi, E.; Cross, L. E. (Pennsylvania State Univ., University Park). J. Appl. Phys.; 44: No. 6, 2541-2544(Jun 1973).

The spontaneous electric polarization $P_S$ was measured for $Gd_2(MoO_4)_3$ over the temperature range from 4.2°K to the Curie point. Near 4°K, the maximum $P_S$ is slightly less than 0.29 $\mu C/cm^2$ with a very low temperature coefficient. An electric field-enforced phase transition from paraelectric to ferroelectric at temperatures just above zero-field $T_c$ demonstrates the first-order nature of the phase change. Better agreement was found near $T_c$ between $P_S$ and the relation $(T-T_1)^{1/2}$ than between $P_S$ and a Landau-type function. (auth)

**942** DISSOCIATION ENERGY OF $CeO_2$ AND $Ce_2O_2$ MOLECULES. Piacente, V.; Bardi, G.; Malaspina, L.; Desideri, A. (Univ., Rome). J. Chem. Phys.; 59: No. 1, 31-36(1 Jul 1973).

A combination of Knudsen effusions and mass spectrometric techniques was employed in studying the gaseous species in thermodynamic equilibrium with condensed $CeO_2$ and with condensed Ce$-$$CeO_2$ mixtures. A thermodynamic treatment of ion currents yields a value of $\Delta H^0_{298} = 135 \pm 6$ kcal mole$^{-1}$ for the heat of vaporization of $CeO_2(s)$. The reactions $Ce(g) + CeO_2(g) \rightleftharpoons 2CeO(g)$ (1) $Ce_2O_2(g) \rightleftharpoons 2CeO(g)$ (2) were studied and it was found that $\Delta H^0_{298} = -19 \pm 4$ kcal mole$^{-1}$ and $\Delta H^0_{298} = 90 \pm 6$ kcal mole$^{-1}$ for reactions (1) and (2), respectively. Utilizing these heats of reaction, the $CeO_2$ and $Ce_2O_2$ atomization energies at 298°K were determined to be $D^0_{298}(CeO_2) = 350 \pm 15$ kcal mole$^{-1}$ and $D^0_{298}(Ce_2O_2) = 474 \pm 15$ kcal mole$^{-1}$. (auth)

**943** CRYSTAL STRUCTURES OF $Nb_2O_5$ MODIFICATIONS AND THEIR CRYSTALLOCHEMICAL RELATIONSHIPS TO RELATED OXIDE STRUCTURES. Petter, W. Diss. Nr. 4396. Zurich; Eidgenoessische Technische Hochschule (1972). 152p. (In German).

Thesis.

The method of chemical transport reaction was particularly suitable for the production of $Nb_2O_5$ single crystals. The crystal structure of a new $Nb_2O_5$ modification was determined with the heavy-atom method. An additional new modification could not be obtained as a pure single crystal, but the principles of the structure could be established. For octahedral structures, a system was developed in such a way that the properties of related transition metal oxides could be predicted. (11 tables, 22 figures, 98 references) (HBG)

**944** HIGH-TEMPERATURE PHASE WITH THE ζ-CARBIDE STRUCTURE IN THE MOLYBDENUM–CHROMIUM–CARBON SYSTEM. Rudy, E. (Oregon Graduate Center, Beaverton). J. Less-Common Metals; 33: No. 3, 327-332(Dec 1973).

The crystal structure of $\zeta$-$(Mo, Cr)_4C_{3-x}$ was determined from x-ray powder photographs and the phase shown to be isomorphous with $\zeta$-$Hf_4N_3$ and the ζ-phases in the Group V metal–carbon systems. The structure is trigonal, space group $D^5_{3d}$-R$\bar{3}$M, with a rhombohedral unit cell of $a_R = 9.757$ Å, $\alpha = 17°22'$ (hexagonal axes: a = 2.982 Å, c = 28.81 Å) at a composition $(Mo_{0.77}, Cr_{0.23})_4C_{2.58}$. The unit cell contains 12 close-packed metal layers in stacking sequence $(hhcc)_3$, or ABABCACABCBC. The metal atoms are statistically distributed among point positions 6(c). The carbon atoms are assumed to occupy octahedral interstitial sites in 6(c), 3(a), and 3(b). Possible carbon ordering on 6(c) and 3(a), with point position 3(b) unfilled, could not be determined as a result of the low scattering power of carbon. The ζ-carbide (ideal: 42.86 at. % C) has a carbon defect between 5 and 6 at. % nearly independent of the metal exchange, and decomposes below ~1650°C into $\eta$-$(Mo, Cr)_3C_2$ solid solution and subcarbide $(Mo, Cr)_2C$. The phase is obtained homogeneous between chromium exchanges of 12 at. % (a = 3.00 Å, c = 28.95Å) and ~54 at. %(a = 2.915 Å, c = 27.92 Å). (auth)

**945** STRUCTURE OF URANYL MOLYBDATE. Serezhkin, V.N.; Kovba, L.M.; Trunov, V.K. (M. V. Lomonosov Moscow State University). Sov. Phys.–Crystallogr. 17: No. 6, 999-1001 (May 1973).

We have determined the crystal structure of $UO_2MoO_4$. It is composed of $(UO_2)O_5$ pentagonal bipyramids and $MoO_4$ tetrahedra. It is concluded that $UO_2MoO_4$ and the isostructural compounds $UO_2SO_4$, $UO_2CrO_4$, and $UO_2WO_4$ are uranyl compounds. (auth)

# Metals and Alloys

*Refer also to abstracts 2008, 2392, and 2394.*

**946** PLUTONIUM-DOKUMENTATION. Transplutonium-Elemente. Referate Zeitschrift. Sep 1973. Band 7, Heft 9. 180 Referate (Register Nr. 3679-4028); 106 Referate (Register-Nr. 631T-736T). (Plutonium Documentation. Transplutonium Elements. Abstract Journal. Sep 1973. Vol. 7, No. 9. 180 Abstracts (Register No. 3679-4028); 180 Abstracts (Register No. 631T-736T)). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung m.b.H. (Sep 1973). 116p. (In German and English).

**947** PLUTONIUM-DOKUMENTATION. Transplutonium-Elemente. Referate Zeitschrift. Jul 1973. Band 7, Heft 7. 269 Referate (Register Nr. 2693-3221); 70 Referate (Register-Nr. 470T-539T). (Plutonium Documentation. Transplutonium Elements. Abstract Journal. Jul 1973. Vol. 7, No. 7. 269 Abstracts (Register No. 2693-3221); 70 abstracts (Register No. 470T-539T)). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung m.b.H. (Jul 1973). 153p. (In German and English).

## Corrosion and Erosion

*Refer also to abstract 2049.*

**948** (GEAP-13919-2) LMFBR HEAT EXCHANGER MATERIALS DEVELOPMENT PROGRAM SECOND QUARTERLY PROGRESS REPORT, SEPTEMBER–NOVEMBER 1972. (General Electric Co., Sunnyvale, Calif. Breeder Reactor Dept.). Dec 1972. Contract AT(04-3)-189. 48p. Dep. NTIS $5.45.

Research directed to measuring corrosion and mass transfer reactions in heat exchanger materials exposed to contaminated Na containing moisture is summarized. Other work is reported on kinetics of interstitial transport associated with secondary heat transfer system Na and the effects of interstitial impurity content on the mechanical properties of heat exchanger materials. Research results are also included on methods of identifying operational conditions that lead to stress corrosion cracking of heat exchanger materials. (JRD)

**949** (WARD-NA-3045-6) SODIUM TECHNOLOGY PROGRAM PROGRESS REPORT FOR PERIOD ENDING JULY 31, 1973. Ray, W. E. (Westinghouse Electric Corp., Madison, PA. Advanced Reactors Div.). Sep 1973. Contract AT(11-1)-3045. 87p. AT.

Activities in friction and wear testing programs simulating FFTF components under operating conditions are summarized along with self-welding tests involving heat-resisting alloys used in FFTF components. Research on the rate and direction of interstitial C and N transfer in FFTF and LMFBR structural materials exposed in liquid metal circuits is also summarized. Investigation results on duct load pad materials is reported on compatibility of surface coatings with Na, thermal cycling stability of the coatings, and mechanical integrity of the coatings. (JRD)

**950** ANODIC BEHAVIOR OF TUNGSTEN SINGLE CRYSTALS IN DILUTE ALKALI SOLUTIONS. Atanasyants, A. G.; Reshetnyak, V. G. (Moscow Inst. of Chemical Tech.). Russ. J. Phys. Chem. (Engl. Transl.); 47: No. 3, 430-431(Mar 1973).

Translated from Zh. Fiz. Kdim.; 47: No. 3, 753-755(Mar 1973).

The effect of crystallographic orientation on the anodic behavior of a tungsten single crystal in dilute aqueous KOH solution is demonstrated for the region of active anodic dissolution and for the passivation region. (auth)

**951** WEAR AND FRICTION IN LIQUID SODIUM AND ARGON MEDIA. Elie X. (CEN de Cadarache, Saint-Paul-les-Durance, France); Fontaine, J. P. (CEN de Cadarache, Saint-Paul-les-Durance, France). Mecan. Mater. Elec.; 55: No. 265-2, 53-71 (1972). (In French).

Fast reactors have various mechanisms functioning in high-temperature liquid sodium. A first series of tests was carried out with test pieces in the form of two circular rings, one rotating and the other fixed, immersed in a crucible filled with liquid sodium. A second series of tests was carried out in order to resolve the problems concerning a sealed outlet mounted on a tank containing sodium vapor at 200° C. Flat test pieces were used in an air–argon atmosphere. Seizure conditions, wear rates, and coefficients of friction were studied. A third series of tests was carried out on friction in liquid metal media using two different machines: a plane surface on plane surface friction machine and an axle/bearing friction machine. (FR)

**952** OXIDATION OF U–14 AT. % Zr BETWEEN 700 AND 900°C. Cathcart, J. V.; Petersen, G. F. (Oak Ridge National Lab., TN). Oxidation Metals; 7: No. 1, 31-43(Aug 1973).

The oxidation properties of the binary alloy U–14 at. % Zr were investigated in 700 to 900°C in oxygen at a pressure of 0.05 torr. Typical oxidation rate curves are presented, and the morphology of the oxide scale is discussed. The creep rate of the alloy during oxidation and a possible mechanism of stress generation are presented. The oxide morphology and the spatial redistribution of the Zr during oxidation are discussed in terms of the relative stabilities of the oxidation products. (auth)

**953** EFFECT OF MOLYBDENUM ON CORROSION BEHAVIOR OF IRON–CHROMIUM ALLOYS. Rockel, M. B. (Vereingte Deutsche Metallwerke, Altena, Ger.). Corrosion; 29: No. 10, 393-396(Oct 1973).

Fe–18Cr alloys with additions of 2, 4, 6, and 8% Mo are studied in 1N $H_2SO_4$ at 25°C. The effect of Mo on potential–current density curves is determined potentiostatically. Increasing Mo content causes the critical current density to decrease, and the open circuit potential to become more noble. Alloys with 8% Mo do not show any anodic dissolution peak and passivate spontaneously. Some theoretical considerations of the passivation mechanism are discussed in connection with additional electrochemical measurements. (auth)

**954** EFFECT OF AGING ON ANODIC BEHAVIOR OF Ni–Cr–Mo ALLOYS. Hodge, F. G. (Cabot Corp., Kokomo, IN). Corrosion; 29: No. 10, 375-383(Oct 1973).

The precipitation response of corrosion-resistant alloys based on the Ni–Cr–Mo phase diagram is complex with both intermetallic and carbide phases being formed during aging in the 650 to 1090°C range. Although these phases markedly affect the corrosion resistance, their composition and structure have not been fully defined. Data are presented to show that the precipitating intermetallic phase in Hastelloy alloy C-276 is a $(Ni, Fe, Co)_3 (W, Mo Cr)_2$ Mu phase and the carbide is an $M_6C$. Both phases have been shown to significantly increase the anodic dissolution rate of the passive region in boiling 10% sulfuric acid. Intergranular attack on aged alloy C-276 samples occurred due to attack of depleted regions in reducing acids and direct dissolution of precipitates under oxidizing conditions. (auth)

**955** OXIDATION OF A ZIRCONIUM–0.11% CARBON ALLOY. Ahmed, T.; Keys, L. H.; Wallwork, G. R. (Univ. of New South Wales, Kensington, Australia). J. Less-Common Metals; 33: No. 3, 369-376(Dec 1973).

Catastrophic failure of a Zr–0.11%C alloy occurs after short periods of parabolic oxidation. This "break-away" phenomenon is explained as being due to a metal cracking process as a result of solid solution of oxygen in the metal substrate. The subsequent oxidation of the thin metal laths so formed better accounts for the overall rate of oxidation than the previously suggested mechanisms. 5 figures. (auth)

**956** **HEAT OF ADSORPTION OF BARIUM ON (100) AND (110) FACES OF TUNGSTEN AND MOLYBDENUM. Bondarenko, B.V.; Konovalov, N.D.; Tishin, E.A. (Moscow Physicotechnical Institute). Sov. Phys.–Solid State 14: No. 12, 3078-3078 (June 1973).**

**957** **COMPOSITION OF A TWO-DIMENSIONAL OXIDE FILM ON A MOLYBDENUM SURFACE. Kolot, V.Y.; Tatus', V.I.; Rybalko, V.F.; Vodolazhchenko, V.V.; Fogel', Y.M. (Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov). Sov. Phys.–Tech. Phys. 17: No. 11, 1876-1879 (May 1973).**

**Secondary ion–ion emission is used to investigate the effect of temperature on the composition and relative concentrations of different molybdenum oxides in the oxide film formed on a molybdenum surface** in oxygen at a pressure of $5 \cdot 10^{-7}$ torr and molybdenum temperatures of **300–2000°K. Relationships between the relative concentrations of different molybdenum oxides and the temperature are obtained. The effect of temperature on the composition of the molybdenum oxides in the vapor phase above the surface of the molybdenum specimen is measured for the same experimental conditions. These investigations are carried out by ionization of the molybdenum oxide vapor flux from the surface by an electron beam and subsequent mass-spectrometer analysis. Plots of the concentrations of different molybdenum oxides in the vapor flux against temperature are obtained. A comparison of the plots of concentration against temperature for molybdenum oxides on the surface and in the vapor phase indicates the processes responsible for the composition of the oxide film on a molybdenum surface. (auth)**

## *Preparation and Fabrication*

*Refer also to abstract 2411.*

**958** (SLA-73-5080) DEPOSITION OF METAL FILMS BY LASER-CONTROLLED CVD. Berg, R. S.; Mattox, D. M. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1972. 11p. (CONF-731017-1). Dep. NTIS $3.00.

From fourth international conference on chemical deposition vapor; Boston, Massachusetts, USA (7 Oct 1973).

It is shown that a focused laser beam can be used to create local heating sufficient to cause tungsten deposition from the tungsten hexafluoride-hydrogen reaction. Using this technique, tungsten film patterns have been generated. Film resistivities are shown to depend on the linear power density. Problems and limitations of this method of film deposition are discussed. (auth)

**959** PROCESS FOR COATING NIOBIUM WITH COPPER. Lugscheider, W. (to Siemens AG). German Patent 1,916,292. 17 Dec 1970. Filed date 29 Mar 1969. (In German).

The surface of niobium to be coated is placed in contact with the copper that is pure on the surface at least. The niobium is then heated to a temperature of 800 to 2500°C, under vacuum, with a residual gas pressure of $10^{-4}$ mm Hg at the most, which produces the bonding of the copper with the niobium. (TSS)

**960** HIGH-TEMPERATURE-RESISTANT STEEL AND NICKEL ALLOYS. Reiff, K. (to Siemens AG). German Patent 1,758,036. 10 Dec 1970. Filed date 23 Mar 1968. (In German).

High-temperature-resisting steels and nickel alloys of composition that can be used as fuel jackets and materials of construction for nuclear reactors are described. They are doped with the boron isotope $^{11}$B. (TSS)

**961** LIQUID METALS PURIFICATION DEVICE. Jansing, W.; Buscher, E.; Heitmeyer, P.; Kirchner, G. (to Internationale Atomreaktorbau). German Patent 1,758,953. 4 Mar 1971. Filed date 7 Sep 1968. (In German).

A device described for the purification of liquid metals, in particular for nuclear reactors, consists of a closed, vertical, oblong vessel fitted with inlet and outlet connections, traversed by the liquid metal to be purified, fitted with a cooling device, along with a heat exchanger to transfer the heat from the liquid metal that is entering to the liquid metal that is leaving. The device is characterized by a porous body of homogeneous constitution arranged in one or more parts in the vessel traversed in a uniform manner in every section by the liquid metal to be purified. The porous body is extended to a cooling system of the vessel or of the tubes grouped among the vessel parts, and by means of one or more exchanger tubes allows liquid metal evacuation toward the top into the purified metal circuit starting with a collection chamber located in the porous medium. (TSS)

**962** CONSTRUCTION ELEMENT MADE OF ZIRCONIUM OR A ZIRCONIUM ALLOY. Spalthoff, W. (to Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt mbH). German Patent 1,903,009. 3 Sep 1970. Filed Date 22 Jan 1969. (In German).

The element described has a joint with a metal or a metallic alloy that has an affinity for hydrogen greater than that of zirconium alloy, which acts as a getter of hydrogen. (TSS)

## *Properties, Structure, and Phase Studies*

*Refer also to abstracts 3, 220, 258, 334, 336, 940, 1571, 1910, 2007, 2078, 2356, 2357, and 2399.*

**963** (CONF-731106-1) PRECISION MEASUREMENTS OF THE THERMAL CONDUCTIVITY, ELECTRICAL RESISTIVITY, AND SEEBECK COEFFICIENT FROM 80 TO 400 K AND THEIR

APPLICATION TO PURE MOLYBDENUM. Moore, J. P.; Williams, R. K.; Graves, R. S. (Oak Ridge National Lab., Tenn. (USA)). 1973. 38p. Dep. NTIS $4.00.

From thirteenth international conference on thermal conductivity; Lake Ozark, Missouri, USA (5 Nov 1973).

A longitudinal heat flow technique for precise measurement of thermal conductivity, electrical resistivity, and Seebeck coefficient over the temperature range from 80 to 400°K is described. The basis of the technique is the use of a calibrated platinum resistance thermometer to provide in-situ calibrations of specimen thermocouples. The total determinate errors at 273°K are ± 0.23% for electrical resistivity, ±0.49% for thermal conductivity, and ±0.07 $\mu$v/K for the Seebeck coefficient when Pt wire is used as the reference. Experimental results on two high-purity molybdenum specimens with cross-sectional areas differing by a factor of four are presented to demonstrate the system precision and low level of indeterminate errors. (9 figures, 5 tables, 30 references) (auth)

**964** (COO-3476-4) LOCALIZED OBSTACLES TO LOW-TEMPERATURE DISLOCATION MOTION IN BCC TUNGSTEN. Dralla, J. R. (State Univ. of New York, Stony Brook (USA). Dept. of Materials Science). Aug 1973. Contract AT(11-1)-3476. 93p. Dep. NTIS $6.75.

Thesis.

An investigation was made of the localized obstacles to dislocation motion in tungsten single crystals from 4.2 to 298°K, using a compressional microstrain technique. Crystals of (100), (110), (111), and 14°-(100) orientation were studied in relation to dislocation structure and ultra high vacuum electron bombardment purification procedures, and correlated with microstrain parameters. Ultra high vacuum degassing reduced both the dislocation and interstitial content while increasing the residual resistivity ratio, RRR = $\rho$ (273°K/$\rho$4.2°K $\simeq 2 \times 10^3$. Total interstitial contents less than 1 ppM were reached. Dislocation densities of the various orientation crystals varied from $\simeq 6 \times 10^5$ to $3 \times 10^6$/cm$^2$. Elastic limit determinations of crystals of varying purity levels gave an average value of $\sigma_E \simeq 0.10$ kg/mm$^2$ at 298°K and a mild temperature dependence below 150°K. $\sigma_E$ is $\simeq 0.35$ kg/mm$^2$ for as-grown and $\sigma_E$ is $\simeq 0.20$ kg/mm$^2$ at 4.2°K for crystals of ultra-high purity. Anelastic limit values were found to be strongly dependent on purity levels at 4.2°K. Thermal activation analysis, in terms of the activation parameter-v*, gave values of $2 \times 10^3 b^3$ in the microstrain region. Etch pit motion experiments at 4.2°K revealed dislocation velocities of $5 \times 10^{-6}$ cm/sec ±20%. Dislocation damping loops at low stress levels $\simeq$10 kg/mm$^2$, as defined by the decrement $\Delta$, were found to be dependent on the magnitudes of the stress amplitude. Relative to the stored energy in the specimens, the energy loss rises to a maximum at $\simeq$1 kg/mm$^2$, and then falls off to a plateau value up to the anelastic limit, $\sigma_A$. Associated with the anelastic limit and its decrease in magnitude with increasing temperatures is the "trapping" of dislocations at large strain amplitudes, $\simeq 10^{-4}$ by impurity atoms. The use of the pinned-string model of dislocation bowing was found insufficient to explain the large amounts of fractional modulus change. Edge dislocation motion and interaction with interstitial impurities are believed to control the initial motion of dislocations and subsequent damping behavior. (18 figures, 3 tables, 64 references) (auth)

**965** (MLM-2068, pp 52-55) METALLURGY. Wittenberg, L. J. (Mound Lab., Miamisburg, Ohio (USA)). 22 Aug 1973.

In Mound Laboratory activities for the Division of Physical Research: January–June 1973.

Erratic results from two experiments in which attempts were made to determine the viscosity coefficient of uranium are discussed briefly. (LMT)

**966** (ORNL-TM-4250) FUELS AND MATERIALS DEVELOPMENT PROGRAM QUARTERLY PROGRESS REPORT FOR PERIOD ENDING MARCH 31, 1973. Patriarca, P. (Oak Ridge National Lab., Tenn.). Jul 1973. Contract W-7405-eng-26. 167p. AT.

Research and development progress is reported on FTR neutron-absorber materials, steam generator and heat exchanger materials, materials for fast reactor fuel cladding, materials for fast reactor structures, welding of FBR components, pipe welding, and nondestructive testing. (JRD)

**967** MEASUREMENT OF THE ENTHALPY OF MIXING IN THE GALLIUM–INDIUM–TIN SYSTEM BY QUANTITATIVE DIFFERENTIAL THERMAL ANALYSIS. Skoropanov, A. S.; Mechkovskii, L. A.; Zakharov, D. M.; Vecher, A. A. (Belorussian State Univ., Minsk). Russ. J. Phys. Chem. (Engl. Transl.); 47: No. 3, 426-427(Mar 1973).

Translated from Zh. Fiz. Khim.; 47: No. 3, 749-750(Mar 1973).

The enthalpy of mixing in the ternary Ga–In–Sn system, and in the lateral binary systems, was determined by quantitative differential thermal analysis. The highest values of the enthalpy of mixing for the Ga–Sn system is 214 ± 6 cal g-atom$^{-1}$, and for the In–Sb system 72 ± 2 cal g-atom$^{-1}$. The experimental results for the ternary system are presented as contour lines of equal enthalpy. (auth)

**968** THERMODYNAMIC PROPERTIES OF LIQUID URANIUM–GALLIUM ALLOYS. Lebedev, V. A.; Seregin, V. N.; Poyarkov, A. M.; Nichkov, I. F.; Raspopin, S. P. (Ural Polytechnic Inst., Sverdlovsk, USSR). Russ. J. Phys. Chem. (Engl. Transl.); 47: No. 3, 402-403(Mar 1973).

Translated from Zh. Fiz. Khim.; 47: No. 3, 712-713(Mar 1973).

The thermodynamic properties of the compound $UGa_3$ and the liquid solutions in equilibrium with it were investigated by an emf method in the range 423 to 811°C. The results are compared with the available data. (auth)

**969** RELATION BETWEEN THE COMPRESSIBILITIES AND MELTING POINTS OF METALS. Kazragis, A.; Surotkevicius, E.; Vosilius, P.; Liksiene, R. (Inst. of Civil Engineering, Vilna, USSR). Russ. J. Phys. Chem. (Engl. Transl.); 47: No. 3, 386-388(Mar 1973).

Translated from Zh. Fiz. Khim.; 47: No. 3, 691(Mar 1973).

On the hypothesis that the compressibilities of substances and their melting points depend on the interatomic interaction energy, the relation between the compressibilities and the melting points of metals is considered. The relation is expressed in terms of correlation power equations. (auth)

**970** INFLUENCE OF ANHARMONIC EFFECTS ON THE THERMODYNAMIC PROPERTIES OF METALS WITH BODY- AND FACE-CENTERED CUBIC LATTICES AT HIGH TEMPERATURES. Fedorov, V. B.; Solov'ev, G. S.; Bukatov, V. G. (All Union Research and Design Inst. for Refractory Metals and Hard Alloys, Moscow). Russ. J. Phys. Chem. (Engl. Transl.); 47: No. 3, 297-299(Mar 1973).

Translated from Zh. Fiz. Khim.; 47: No. 3, 522-525(Mar 1973).

The coefficients of linear expansion of metals with body- and face-centered cubic lattices at high temperatures are calculated in terms of the one-particle model of the crystal. (auth)

**971** ELECTRICAL RESISTIVITY OF YTTERBIUM THIN FILMS. Bist, B. M. S.; Srivastava, O. N. (Banaras Hindu Univ., India). Thin Solid Films; 18: No. 1, 71-75(Oct 1973).

Electrical resistivity measurements on ytterbium thin films at room temperature in the thickness range 200 to 850 Å are described. An approximate mean free path of 500 Å for conduction electrons has been deduced from the thickness variation of the electrical resistivity. Partially oxidized films exhibit an electric conductivity variation with thickness; this also is discussed. (auth)

**972** CREEP AND DURABILITY OF BORON-SILICIDE COATED MOLYBDENUM IN VACUO AT 1000 TO 1400° C. Zelenyuk, E. E.; Krivenyuk, V. V.; Sosnovskii, L. A. Probl. Proch. Mashinostr.; No. 2, 53-56(Feb 1973). (In Russian).

Results are presented of tests on creep and long-stability of smooth and notched samples of molybdenum with a borosilicide coating, in vacuo, at temperatures of 1000 to 1400° C. It was established that, under the conditions used, the strength of smooth samples with a coating was higher than that of the basic material. In tests of the smooth samples the coatings showed no effect on the properties of the basic material, and in tests of notched samples the plasticity was affected. The coating did not affect the manner of long-term destruction of the basic material. (tr-auth)

**973** EFFECT OF YTTRIUM ON DENSITY OF STEEL. Ekhtelis, L. S.; Gladkov, M. I.; Stasyuk, G. F.; Karmalin, Yu. N.; Borovskii, O. B. Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 11, 50-3(1972). (In Russian).

The following effects of yttrium additions were studied: change in density of steel (types 40L and Kh18N9L) in the liquid state; effect of isothermal aging on change in density; and the kinetics of transformation from the liquid to the solid state. The steel density was determined by $\gamma$-ray penetration in the interval 1600 to 1300° C. Alloying by small additions of yttrium (up to 0.2%) increased the density of the steel in the liquid state, but adding up to 0.5% decreased the density. In the temperature interval mentioned, the density change was linear. The density increased sharply in the crystallization stage. (tr-auth)

**974** TEMPERATURE DEPENDENCE OF NITROGEN SOLUBILITY IN MELTS OF IRON WITH TRANSITION METALS. Bol'shov, L. A.; Grigoryan, V. A.; Stomakhin, A. Ya. (Moscow Inst. of Steel and Alloys). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 11, 60-62(1972). (In Russian).

A method of predicting the temperature dependence and solubility of nitrogen in multicomponent alloys is applied to alloying components—the transition metals—to obtain a theoretical basis for examination of the phenomenon of ordering. A method is proposed for estimating the temperature dependence of nitrogen solubility in complex alloys from experimental values of enthalpy parameters. (tr-auth)

975 DURABILITY PROPERTIES OF LAYERS PREPARED BY ELECTRIC-SPARK ALLOYING OF STEELS WITH REFRACTORY METALS. Pisarenko, G. S.; Samsonov, G. V.; Verkhoturov, A. D.; Benzykornov, A. I.; Lyashenko, B. A.; Rishin, V. V.; Shemegan, Yu. M. Probl. Proch. Mashinostr.; No. 2, 102-111 (Feb 1973). (In Russian).

The effects of a stress state of the surface layer of steel subjected to electric-spark strengthening on the following properties were studied: strength of adherence and shear, distribution of residual tension, microhardness, fatigue strength. The dependence of these properties on strengthening regimes and alloying elements was investigated by x-ray structural analysis and laminar spectral analysis to show structure, phase conversion, and depth of interacting diffusion penetration of the strengthened material and the base. The results of the studies showed a dependence of the stress state and strength on the temperature of the conversion of the alloyed material to the brittle state, the possibility of formation of inorganic solid solutions of the anode and cathode material, and other factors. (tr-auth)

976 EFFECT OF PLASTIC DEFORMATION ON ELECTRICAL RESISTIVITY OF MOLYBDENUM MONOCRYSTALS. Pirogova, S. V.; Burov, I. V.; Savitskii, E. M. (Inst. of Metallurgy, Moscow). Probl. Proch. Mashinostr.; No. 2, 73-75(Feb 1973). (In Russian).

The effect of crystal lattice defects, due to plastic deformation of monocrystal molybdenum, on changes in electrical resistance at 4.2° K was studied. For separation of the contribution of vacancies and dislocations to electrical resistance, samples were annealed at 800° K after deformation. It was established that the residual resistance due to vacancies in molybdenum was $4 \times 10^{-5}$ ohm cm/at.% and that due to dislocations of the order of $10^{-16}$ ohm $cm^3$. (tr-auth)

977 PHENOMENON OF TRANSFORMATION INTO A STRUCTURELESS FLUID IN PURE METALS AND SEMICONDUCTORS. Filippov, E. S. (Moscow Inst. of Steel and Alloys). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 11, 122-127(1972). (In Russian).

A new phase transformation was found in the superheating of liquid metals, semiconductors, and alloys at 700 to 900° C above the melting point. The superheating temperature at about 800° C is called the temperature of transition to a statistical packing state of atoms or transition to a structureless fluid. The transformation is accompanied by an increase in volume and absorption of heat upon heating in the range 0 to 80° C. As an example, with Ag, Cu, Ge, Ga, and In, the volume increase and heat absorption in statistical packing equal those of melting. Depending on the nature of the stepwise increase in density (at 0 to 80° C), the conversion to the statistical packing state may go to a phase transformation of both the first and second types. By extrapolation of the volume to 0° K, coordination numbers in the statistical packing stage are found. The constants of the material are examined for the time when the settled life of an atom equals the time of its conversion. In the statistical packing state the excess energy of self-diffusion is applied to each atom. The discovery of the transition to the statistical packing state, like the phase transformation, allows propagation of the "lever principle" to the liquid phase region for determining the fraction of the order state of the atoms and the fraction of statistical packing of the atoms at a temperature between the melting point and the statistical packing temperature. (tr-auth)

978 ORBITAL CONTRIBUTIONS TO THE TRANSFERRED HYPERFINE FIELDS IN RARE-EARTH COMPOUNDS. Dunlap, B. D. (Argonne National Lab., IL); Nowik, I.; Levy, P. M. Phys. Rev., B; 7: No. 9, 4232-4241(1 May 1973).

Magnetic hyperfine fields acting on the nuclei of diamagnetic atoms in rare-earth intermetallic compounds are generally assumed to follow a form $H_{hf} = H_s(g_J - 1) \langle J_z \rangle$. However, such an expression is inadequate to describe the detailed dependence of the transferred hyperfine fields as the rare-earth ion is changed. It is shown that an expression based on a Hamiltonian which includes orbital contributions to the hyperfine field can describe the available data on several series of rare-earth compounds. This dependence has the form $H_{hf} = [(g_J - 1)H_{01} + (2 - g_J)H_{10} + c_n H_{21}] \langle J_z \rangle$, where the $c_n$ are appropriate rare-earth reduced matrix elements. By fitting the extant data to this expression, it is found that the orbital contributions $H_{10}$ and $H_{21}$ are appreciable. The general form of this expression is found to be valid for a variety of mechanisms which produce transferred and supertransferred hyperfine fields. (4 tables, 3 figures, 30 references) (auth)

979 SPIN-ORIENTATION DIAGRAMS AND MAGNETIC ANISOTROPY OF RARE-EARTH–IRON TERNARY CUBIC LAVES COMPOUNDS. Atzmony, U. (Nuclear Research Center, Negev, Israel); Dariel, M. P.; Bauminger, E. R.; Lebenbaum, D.; Nowik, I.; Ofer, S. Phys. Rev., B; 7: No. 9, 4220-4232(1 May 1973).

Directions of the easy magnetization in the $Ho_xTb_{1-x}Fe_2$, $Ho_xEr_{1-x}Fe_2$, $Dy_xTb_{1-x}Fe_2$, $Dy_xEr_{1-x}Fe_2$, and $Ho_xTm_{1-x}Fe_2$ systems were determined as a function of x and temperature by means of the Moessbauer effect in $^{57}Fe$. If the direction of magnetization of each system is described by a (x,T) spin–orientation diagram, it is found that the (x,T) plane is divided into two or three regions, in each of which the direction of magnetization is along a different major crystal axis. Theoretical calculations based on the assumption that the magnetic crystalline anistropy is due to the anisotropy of the interaction between the 4f electrons of the rare-earth ions with the crystal fields reproduced the general features of the experimental results though small discrepancies remained. Taking into account an additional contribution to the anisotropy attributed to the Fe–Fe interaction improved the agreement between the theoretical and experimental spin-orientation diagrams. From the theoretical fits to the experimental results a value of $(-0.038 \pm 0.003)\alpha_0^{-2}$ is derived for the ratio of the crystal field parameters $A_6/A_4$. The transitions between the regions of the spin–orientation diagrams are not sharp. Possible reasons for the existence of the transition regions are discussed. (9 figures, 3 tables, 15 references) (auth)

980 PLASTIC DEFORMATION OF HAFNIUM–OXYGEN ALLOYS. Tyson, W. R. (Trent Univ., Peterborough, Ont.); Conrad, H. Met. Trans.; 4: No. 11, 2605-2611(Nov 1973).

The plastic-flow kinetics of hafnium single crystals and polycrystals of a range of oxygen contents were investigated over the temperature range of 77 to 873°K employing the technique of incrementally changing the temperature and strain rate. It was found that $\tau_0^* \approx 2.4 \times 10^{-3} \mu_0 \sqrt{C_i}$, where $\tau_0^*$ is the effective critical resolved shear stress extrapolated to 0°K, $\mu_0$ the modulus at 0°K, and $C_i$ the total interstitial content (0.05 to 1.16 at. %). Using the theory of thermally activated deformation, it is concluded that overcoming local interstitial obstacles is rate controlling over the temperature range of 77 to 750°K and that the obstacles are characterized by a Gibbs activation free energy $\Delta G$ at 0°K and zero effective stress of ~1.7 eV ($0.14 \mu_0 b^3$). Results for single crystals and polycrystals are in agreement using a Taylor factor of 3.5 for the ratio of tensile to shear stress. (33 references) (auth)

981 PLASTIC DEFORMATION OF INDIUM SINGLE CRYSTALS. Van der Biest, O.; Van der Planken, J. (Univ. of California, Berkeley). Acta Met.; 21: No. 12, 1629-1639(Dec 1973).

Indium single crystals, prepared either by a special casting technique or by the Bridgman method, were deformed in tension on an Instron, at three different temperatures, or on a Hounsfield, in liquid nitrogen. At 77°K the (111) plane, being the most densely packed is the only active glide plane; the critical shear stress amounts to 20 g/mm². Twinning, the most pronounced deformation mode, at 77°K occurs along (101) and at a shear stress of about 70 g/mm². At room temperature slip was observed to take place along (001) and (101) planes. Interactions between slip and twinning at 77°K were studied by optical microscopy during the test, whereby the specimen remained under liquid nitrogen, and by scanning electron microscopy on specimens after fracture. The results are in accordance with the Bell and Cahn mechanism for twinning. (auth)

982 CHARACTERISTICS OF THE TEMPERATURE DEPENDENCE OF THE MICROHARDNESS OF A HIGHLY HEAT-RESISTANT DISPERSION-HARDENED NICKEL ALLOY. Buntushkin, V. P.; Babich, B. N. (Moscow Aviation Inst.). Probl. Prochnosti; 5: 108-110(May 1973). (In Russian).

The behavior of the microhardness of the VDU-1 alloy (Ni plus 2.5% ThO2) is studied in the temperature range from 20 to 1200°C. The lgH-T curve is linear with salient points at 250 to 300°C. This applies also to pure nickel, whereas the complex aging alloy KhN56VMKlu and KhN51VMTUIKFR exhibit salient points at 900 to 950°C. The rate at which hardness decreases with increasing temperature (slope of the straight segment of the LgH-T curves) appears to characterize the rate of the diffusion processes and the thermal stability of the metal's structure. (IAA)

983 DOPPLERONS AND GANTMAKHER–KANER EFFECT IN Cd. Naberezhnykh, V. P.; Eremenko, T. M. (Physical Technical Inst., Donetsk, USSR). Phys. Status Solidi (b); 58: No. 2, K175-K178(1 Aug 1973).

A perpendicular magnetic field excites an electromagnetic field in a metal, owing to the shift of the maximum cyclotron period from the skin to the metal inside. This field results in an oscillatory dependence of plate impedance on the magnetic field which is called the Gantmakher–Kaner (GK) effect. The case of a weakly damping wave, when the solutions of the dispersion equation are almost real and the skin depth is absent, is considered. Doppler-shifted cyclotron resonance for helicon propagation in metals with one type of carrier, is produced. The so-called doppleron (second branch of the helicon spectrum) is discussed. In order to estimate the relation of the two phenomena, oscillations in Cd were studied in an experimental geometry where electrons of lens with extremum $\partial S/\partial P_z$ are responsible for oscillations. Results can be explained: the doppleron excites side by side with the GK wave beginning from fields $H \geq 2.5 f^{*}$. The doppleron oscillation increases with frequency, while the GK oscillations decrease. The boundary between the dominances of these oscillations is 2 to 3 MHz. (DLC)

984 SYSTEM FOR REDUCTION OF STRESS PEAKS AT POINT OF SUPPORT OF LARGE PRESSURE VESSELS, ESPECIALLY FOR REACTOR SAFETY VESSELS. Jochum, F. (to Gg. Noell and Co.). German Patent 1,921,666. 12 Nov 1970. Filed Date 28 Apr 1969. (In German).

The system contains a vessel with rotational symmetry, influenced by temperature or pressure, and supported by a concrete pad. The pad contains, in the region of the outlet from the vessel, a groove that opens into the vessel and is filled at least partially with liquid. (TSS)

985 TITANIUM ALLOYS AND THEIR FABRICATION. Ajkai, L. Magy. Alum.; 9: No. 12, 389-392(1972). (In Hungarian).

Compositions and mechanical properties of Ti alloys, containing Al, Mn, Mo, V, and/or Zr, are discussed and their heat-treatments, workabilities, machinabilities, and required joining techniques are described. (Metals Abstr.)

986 HALL EFFECT, RESISTIVITY, AND ELASTIC CONSTANTS OF Nb AND Nb-RICH Zr ALLOYS. Hayes, D. J. Houston, TX; Rice Univ. (1973). 87p. University Microfilms Order No. 73-21,556.

Thesis (Ph. D.).

The Hall coefficients, resistivities, and elastic constants of oriented single crystals of pure Nb and of a series of Nb-rich Zr alloys were measured as a function of temperature between 295 and 4.2°K. The variation of the Hall coefficient (R) with composition is discussed in terms of changes in the density of states at the Fermi level with alloying. A sharp dip occurs in R for pure Nb between 20 and 40°K, the origin of which is still uncertain. The temperature dependence of R for the alloys suggests that impurity scattering is more anisotropic than phonon scattering for Nb-rich Zr alloys. The phonon component of the resistivity $\rho_L$ was found to be proportional to the density of states at the Fermi level. At low temperature $\rho_L$ varied approximately at $T^3$ which is expected for such a high-density-of-states metal as Nb. The elastic constants $C_{11}$, $C'$ and $C_{44}$ were observed to decrease as Zr is added to Nb. The smallest decrease occurred in $C_{44}$. $C_{44}$ is also the elastic constant which exhibits an anomalous temperature dependence for these alloys. The Debye temperature was calculated from the 4.2°K elastic constants and found to agree well with calorimetric data. (Diss. Abstr. Int., B)

987 MOESSBAUER STUDIES OF MAGNETISM IN DILUTE ALLOYS OF TANTALUM AND TUNGSTEN IN IRON. Langhammer, D. Cincinnati; Univ. of Cincinnati (1973). 108p. University Microfilms Order No. 73-24,844.

Thesis (Ph. D.).

The Mössbauer technique was used to study the magnetic interaction $\Delta$ at $^{182}W$ sites in dilute $Ta_xFe_{1-x}$ (x = .001, .004) and $^{182}W_{.03}Fe_{.97}$ alloys using the 100.1-keV gamma resonance. The experiments utilized sources of $^{182}Ta$ in neutron-irradiated arc melted $Ta_xFe_{1-x}$ alloys with absorbers of natural W foils, and a natural linewidth source of $^{182}Ta(Ta)$ with an absorber of $^{182}W$ (Fe). (JRD)

988 ULTRASONIC STUDY OF THE NORMAL-STATE ELECTRONIC PROPERTIES OF PURE NIOBIUM: ANOMALOUS ZERO-FIELD ATTENUATION AND THE MAGNETOACOUSTIC EFFECT. Blessing, G. V. Washington, DC; Catholic Univ. of America (1973). 124p. University Microfilms Order No. 73-22,643.

Thesis (Ph. D.).

An anomaly in the temperature dependence of the normal-state shear-wave attenuation $\alpha_N$, the appearance at low temperatures of a maximum which shifts with frequency, was investigated. It was found that the effect is not influenced by wave-polarization orientation in the (100) plane. A computer analysis of low-frequency $\alpha_N$ data, for which the anomaly was absent near $T_c$, was used to obtain a functional relationship for the electron mean free path l (T). The phonon-limited mean free path was found to have a $T^{4.3}$ dependence in the range 7 to 12°K. These results for l (T) show that the $\alpha_N(T)$ maxima occurred at an essentially fixed q l value (ql = 11.7 ± .3) over a range of discrete frequencies from 195 to 435 MHz. A magnetoacoustic study of niobium's Fermi surface structure was made with the acoustic shear wave's polarization aligned parallel with the two principal lattice directions: $\underline{\varepsilon}\|[010]$ and $\underline{\varepsilon}\|[011]$. It was found that the magnetoacoustic interaction only favors the inclusion of selected closed sheets from the Fermi surface. The data was analyzed in terms of a caliper selectivity based on the component of $\underline{\varepsilon}$ parallel to the electron motion $\underline{v}_f$ at the effective zone sites. On the basis of this analysis excellent agreement is found between experiment and theory for the $\underline{\varepsilon}\|[010]$ data. The data for $\underline{\varepsilon}\|[011]$ are found to be consistent with the foregoing analysis when harmonic mixing between the competing calipers of two Fermi sheets is taken into account. Implications that these results have for the type of interaction that takes place between the sound wave and the electrons in the presence of a magnetic field are then discussed. (Diss. Abstr. Int., B)

989 PHYSICS OF RARE EARTH SOLIDS. Taylor, K. N. R.; Darby, M. T. New York; John Wiley and Sons, Inc. (1972). 318p. $22.50.

This book describes the fundamental physical properties of the rare earths in the solid state and outlines the theory used to interpret and correlate these properties. The six chapters respectively discuss ionic properties of salts, band structures, magnetic properties, transport properties, and rare earth compounds. (DLC)

990 GROUP IIB. Aylett, B. J. (London Univ.). pp 187-328 of Comprehensive Inorganic Chemistry. Volume 3. Trotman-Dickenson, A. F. (ed). Oxford; Pergamon Press Ltd. (1973).

Each of the 3 elements of the IIB group, Cd, Zn, and Hg is discussed from the standpoint of discovery, occurrence, production, uses, isotopes, physical/and chemical properties, biological activity: toxicity, analysis, alloys, compounds, and complexes. (728 references) (JGB)

991 VANADIUM. Clark, R. J. H. (University Coll., London). pp 491-551 of Comprehensive Inorganic Chemistry. Volume 3. Trotman-Dickenson, A. F. (ed.). Oxford; Pergamon Press Ltd. (1973).

The history, occurrence, nuclear, physical, chemical, and biological properties, analytical chemistry, and metallurgical aspects of vanadium are discussed. Detailed information is presented on various vanadium compounds and complexes. (228 references) (JGB)

992 RHENIUM. Peacock, R. D. (Univ. of Leicester, Eng.). pp 905-978 of Comprehensive Inorganic Chemistry. Volume 3. Trotman-Dickenson, A. F. (ed.). Oxford; Pergamon Press Ltd. (1973).

Rhenium is discussed as to its discovery, isolation, and physical and chemical properties. Various rhenium compounds and complexes are considered in some detail. (354 references) (JGB)

993 LOCALISATION OF 5d ELECTRONS IN RARE-EARTH METALS. Devine, R. A. B. (Univ., Montreal); Ludwig, A.; Dixon, J. M. Phys. Lett.; 45A: No. 3, 249-250(24 Sep 1973).

Excess moment in rare-earth metals due to localized 5d character is calculated. Comparison with experimental results shows the localization predicted to be in good agreement with that found from crystalline electric field and field gradient calculations.

994 NEUTRON-DIFFRACTION STUDY OF THE MAGNETIC STRUCTURE OF $Er_{0.75}$ $Lu_{0.25}$. Habenschuss, M.; Stassis, C.; Sinha, S. K.; Spedding, F. H. (Ames Lab., IA). Phys. Lett.; 45A: No. 4, 281-282(8 Oct 1973).

Neutron diffraction studies of an $Er_{0.75}$ $Lu_{0.25}$ alloy single crystal at 4.9 to 78°K show a transition to a c-axis longitudinal spin wave at 68°K and a transition to a slightly distorted antiferromagnetic conical structure at 40°K. No ferromagnetic transition was observed down to 4.9°K. (auth)

995 COMMENT ON THE "ORTHOGONALITY" OF ITINERANT AND LOCALIZED STATES IN HEAVY RARE EARTH METALS. Dixon, J. M. (Univ. of Warwick, Eng.). Phys. Lett.; 45A: No. 4, 319-320(8 Oct 1973).

A method of describing 4f character in itinerant electron wave functions for heavy rare earth metals is given. The consistency of the method with the effects of interband mixing is also discussed. (auth)

996 OBSERVATION OF THE SPIN RESONANCE OF IRON IN A METALLIC HOST. Koopmann, G.; Engel, U.; Huefner, S.; Baberschke, K. (Freie Univ., Berlin). Phys. Lett.; 45A: No. 3, 173-174(24 Sep 1973).

Strong ESR signals with $g = 2.65 \pm 0.05$ are reported for samples of Fe in the superconductor $CeRu_2$.

**997** TEMPERATURE-DEPENDENT PEAK IN ELECTRONIC ATTENUATION OF ULTRASONIC SHEAR WAVES IN CADMIUM. Almond, D. P.; Birks, A. R.; Lea, M. J.; Dobbs, E. R. (Univ. of Lancaster, Eng.). Phys. Lett.; 45A: No. 3, 205-206(24 Sep 1973).

A peak in the attenuation of fast shear waves along $[10\bar{1}0]$ in cadmium is found at 10K and is shown to be due to the geometry of the Fermi surface. (auth)

**998** HIGH-TEMPERATURE BEHAVIOR OF THE RESISTIVITY IN NEARLY MAGNETIC METALS: APPLICATION TO PLUTONIUM. Jullien, R.; Béal-Monod, M.T.; Coqblin, B. (Laboratoire de Physique des Solides, Universitë Paris-Sud, 91405-Orsay, France). Phys. Rev. Lett. 30: No. 21, 1057-1060 (21 May 1973).

We show that, in nearly magnetic metals, taking into account the temperature dependence of the Stoner susceptibility makes the electron-paramagnon electrical resistivity depart from the usual low-temperature $T^2$ and T power laws at temperatures higher than the spin-fluctuation one. A high-temperature plateau is expected and a maximum may arise at lower temperature depending on the parameters. Possible fits are presented for the resistivities of Pu and Np. (auth)

**999** OBSERVATION OF ITINERANT 5f STATES IN THORIUM METAL. Veal, B.W. (Argonne National Laboratory, Argonne, Illinois, 60439); Koelling, D.D.; Freeman, A.J. Phys. Rev. Lett. 30: No. 21, 1061-1064 (21 May 1973).

Normal-incidence reflectivity measurements between 0.5 and 6 eV on thorium metal reveal the existence of bandlike (or itinerant) f states several electron volts above the Fermi energy. The predictions of relativistic band-structure determinations are in qualitative agreement with experiment. This study provides the first direct observation and characterization of 5f electrons in metals as being itinerant in nature and unlike the 4f states in the rare earths. (auth)

**1000** EFFECT OF PROCESSING ON THE WORK FUNCTION OF MOLYBDENUM. Chistyakov, P.N.; Milovanova, R.A. (Moscow Institute of Engineering Physics). Sov. Phys.-Tech. Phys. 17: No. 10, 1707-1708 (Apr 1973).

The values of the work function obtained by the photoelectric method for a polycrystalline molybdenum cathode are compared after the following forms of processing and purification: 1) ion bombardment in a glow discharge at a high current density in an inert gas at a pressure of the order of 10 torr, and 2) electron bombardment in an ultrahigh vacuum. In the first case the values of the work function are 0.15-0.20 eV below the second case; the difference is due to a change in the surface structure and penetration of the ions of the inert gas into the crystal lattice of the metal of the cathode. (auth)

**1001** X-RAY SPECTRAL DATA ON THE VALENCE BAND AND CONDUCTION BAND STRUCTURES IN VANADIUM COMPOUNDS OF $V_3X$ TYPE. Bondarenko, T. N.; Dzeganovskii, V. P.; Zhurakovskii, E. A. (Inst. of Problems in Materials Science, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 7, 1121-1130(Jul 1973). (In Russian).

K- and L-emission spectra and K-absorption spectra of vanadium are obtained for pure V and $V_3Si$, $V_3Ga$, $V_3Ge$, $V_3Sn$, and $V_3Co$. The matching of the spectra in a single energetic scale allowed conclusions to be drawn on the structures of the $V_3X$ valence band and conduction band and a supposition to be verified on similarity in the electronic structures of $V_3X$ as isostructural compounds with constant first component. Interpretation of the $VK\beta_5$-band shape for $V_3X$ is suggested. The experimental results are compared with the calculation results of Mattcheiss. 5 figures, 4 tables, 19 references. (auth)

**1002** THERMODYNAMIC PROPERTIES OF LIQUID SODIUM AND POTASSIUM. Onishchenko, V. P.; Krasnyi, Yu. P. (Odessa State Univ., USSR). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 7, 1194-1200(Jul 1973). (In Russian).

Thermodynamic properties of liquid sodium and potassium are calculated on the basis of general ideas of multielectronic theory for nontransition metals, using the perturbation theory of Barker and Handerson. The calculation was made within a temperature range from the melting point to 1400°K. The theory is in good agreement with experiment. 3 tables, 25 references. (auth)

**1003** RESISTOMETRIC TECHNIQUE FOR ESTIMATION OF INTERSTITIAL IMPURITY LEVELS IN NIOBIUM. Westlake, D. G. (Argonne National Lab., IL). J. Less-Common Metals; 33: No. 3, 391-394(Dec 1973).

A quick, inexpensive method was devised for estimating the concentration of oxygen or interstitial impurities in Nb specimens of any shape. In this method, the electric resistivity is measured at 0°C on one sample of known oxygen content $C_1$ (at. %) $\rho$ and on a sample of unknown O content $(\rho_1)$; then, the O content could be found from the equation $C_1 = (\rho_1 - \rho/5.28) + C_1$. Similarly, the interstitial impurity can be estimated from $C = (\rho - 13.308/0.0003)$ ppM. (DLC)

**1004** YTTERBIUM-NICKEL SYSTEM. Palenzona, A.; Cirafici, S. (Univ., Genoa). J. Less-Common Metals; 33: No. 3, 361-367(Dec 1973).

The binary system ytterbium-nickel was investigated by x-ray diffraction, differential thermoanalysis, and metallography and the corresponding constitutional diagram was derived. At least five intermetallic compounds are present in this system: YbNi, $YbNi_2$, $YbNi_3$, $YbNi_5$, and $Yb_2Ni_{17}$. Crystallographic data already known from preceding work were confirmed. From lattice constant values of these compounds, it appears that ytterbium can form intermetallic compounds with nickel in the trivalent state but in the divalent state gives rise to an extended immiscibility gap in the solid as well as in the liquid phase. (auth)

**1005** THERMODYNAMIC PROPERTIES AND PHASE COMPOSITION OF THE In-Ni SYSTEM. Vinokurova, G. A.; Geiderikh, V. A.; Gerasimov, Ya. I. (Moscow State Univ.). Dokl. Akad. Nauk SSSR; 211: No. 3, 620-623(21 Jul 1973). (In Russian).

The temperature dependence of the emf of the electrochemical series, with electrodes of the type In(liq) $|(KCl-LiCl) + 0.2\ InCl|$ $In_xNi_{1-x}$ was studied in the temperature interval 360 to 670°C. From the emf data and roentgenograms, it was seen that in this temperature interval, under thermodynamic conditions of equilibrium, a phase of the stoichiometric composition $InNi_2$ does not exist. The $\epsilon$ phase at approximately 540°C decays eutectoidally to $InNi_3$, and an $\epsilon'$ phase decays to $InNi_3$ and InNi at approximately 425°C. The integral thermodynamic functions of alloy formation of In-Ni alloys at 673 and 860°K were calculated by numerical integration of the Gibbs-Durgem equation; the data thus obtained are tabulated. (TTT)

**1006** CONTRIBUTIONS TO THE HYPERFINE FIELD IN EUROPIUM INTERMETALLICS. Nowik, I.; Dunlap, B.D. (Argonne National Laboratory, Argonne, Illinois 60439); Wernick, J.H. Phys. Rev. B 8: No. 1, 238-241 (1 July 1973).

Mössbauer studies of $Eu_xYb_{1-x}Al_2$, $Eu_xYb_{1-x}Cu_2$, $Eu_xLa_{1-x}Al_2$, and $EuAl_4$ at low temperatures and in external fields yield the three major contributions to the hyperfine field. In Eu metal, $EuCu_2$, $EuAl_2$, and $EuAl_4$, these are (i) core polarization $H_{core} \approx -340$ kOe, (ii) central-ion conduction-electron polarization $H_{cp} = 190 \pm 20$, $140 \pm 20$, $105 \pm 20$, and $50 \pm 20$ kOe, (iii) neighbor contributions $H_n = -115 \pm 20$, $10 \pm 10$, $-45 \pm 10$, $0 \pm 10$ kOe. The local-ion contribution $H_{core} + H_{cp}$ seems to be correlated to the isomer shift. The field of $Eu^{2+}$ in $YbAl_2$, $Eu^{2+}$ in $LaAl_2$, and $Gd^{3+}$ in $YAl_2$ are $-235 \pm 20$, $-205 \pm 10$, and $-140$ kOe, respectively. This yields $+95 \pm 20$ kOe for the contribution to the hyperfine field of the additional conduction electron in $GdAl_2$ relative to $EuAl_2$ and $-65 \pm 10$ kOe to the screening effect in $Eu^{2+}$ in $La^{3+}Al_2$ relative to $Gd^{3+}$ in $Y^{3+}Al_2$. (auth)

**1007** MOLECULAR-BEAM STUDY OF HYDROGEN-DEUTERIUM EXCHANGE ON LOW- AND HIGH-MILLER-INDEX PLATINUM SINGLE-CRYSTAL SURFACES. Bernasek, S.L.; Siekhaus, W.J.; Somorjai, G.A. (Inorganic Materials Research Division, Lawrence Berkeley Laboratory). Phys. Rev. Lett. 30: No. 24, 1202-1204 (11 June 1973).

The hydrogen-deuterium exchange reaction takes place readily on a platinum single crystal with high Miller index (997), but not detectably on a platinum single crystal of low Miller index (111). The difference in reactivity is ascribed to the large density of atomic steps present on the high-index surface that are responsible for the dissociation of the diatomic molecules. (auth)

**1008** $Al_{10}V$: AN EINSTEIN SOLID. Caplin, A. D.; Grüner, G. (Physics Department, Imperial College of Science and Technology, London SW7, England); Dunlop, J.B. Phys. Rev. Lett. 30: No. 22, 1138-1140 (28 May 1973).

Low-temperature specific-heat and electrical-resistivity measurements show that the intermetallic compound $Al_{10}V$ has a local soft mode of characteristic temperature 22°K. The behavior is well described by an Einstein model. The number of such modes, taken together with x-ray evidence, indicates that the mode is associated with a loose Al atom occupying a large hole in the $Al_{10}V$ structure. This and other peculiarities of the structure provide evidence of important bonding effects. (auth)

**1009** ANISOTROPIC SURFACE STRUCTURE CHANGE IN REFRACTORY METAL CRYSTALS DURING DIRECTIONAL TRANSPORT PROCESSES. Zakurdaev, I.V.; Chernyak, E.Y.; Shuppe, G.N.; Yakovlev, V.N. Sov. Phys.-Solid State 14: No. 12, 2977-2980 (June 1973).

The presence of an electric potential gradient and a temperature gradient in the bulk of refractory metal crystals results, at temperatures of 0.5 $T_m$ and higher, in the anisotropic development of a step-like macrostructure on the crystal surface. It is proposed that the cause of this surface restructuring may be electromechanical forces acting at the metal surface layer. A thermal emission method was used to study the change in the surface state as a function of the magnitude and direction of an electric field in the crystal. The experiments were performed on a specific type of oriented, crystalline disks of molybdenum and tungsten. It was found that the change of emission current, and correspondingly in the forces acting at the surface, depends on the angle between the electric field and one of the simple crystallographic directions. The maximum change in current amounts to 20–30% of the total current from a face during imposition of a field—equivalent to 0.6 to 0.8 V/cm. A change in the emission–current sign was observed on transition from crystals with a <110> direction, to crystals with a <111> direction relative to the axes. A correlation was established between the anisotropic change of emission current and structure development. An evaluation was done of the force acting at the crystal surface from the standpoint of conduction electrons and phonons. (auth)

**1010** INFLUENCE OF PRESSURE ON THE HALL EFFECT IN DYSPROSIUM SINGLE CRYSTALS. Vinokurova, L.I.; Kondorskii, E.I.; Ivanov, V.Y.; Murav'eva, V.M.; Rakhimova, K. (M. V. Lomonosov Moscow State University). Sov. Phys.–Solid State 14: No. 12, 2981-2984 (June 1973).

The influence of hydrostatic compression at a pressure of up to $1 \cdot 10^4$ kg/cm$^2$ on the Hall effect and electrical resistance of dysprosium crystals is experimentally investigated. The measurements were made in the temperature range 77–400°K and in fields up to 22 kOe. It was established that the normal Hall coefficient of dysprosium in the paramagnetic temperature region changes in different ways in different crystallographic directions: For $H \| c$ (measurements along the a axis) compression reduces $R_0$ in absolute value, while for $H \| a$ (measurements along the c axis) compression increases the absolute value of $R_0$. Measurements of the effect along the hexagonal c axis with ferromagnetic ordering in the specimen ($H \| a$) indicated that pressure increases $R_0$ in absolute value. As in the case of polycrystalline specimens, it was found that pressure substantially affects the normal Hall constants and to a lesser degree the anomalous constants $R_s$ and $R_p$, the relative changes $(R_p)^{-1}(\Delta R_p/\Delta_p)$ being of the same order as the changes in the "magnetic" resistance $(\rho_{mag}^{-1})(\Delta\rho_{mag}\Delta p)$ for $T > T_N$. The observed changes in $R_0$ are linked to distortion of the shape of the dispersion curves $E_k$ resulting from a change in the interatomic distances. (auth)

**1011** FORMATION OF PHASES IN W AND MO THIN FILMS. Palatnik, L.S.; Obol'yaninova, O.A.; Naboka, M.N.; Gladkikh, N.T.; Khotkevich, V.I. (Khar'kov Polytechnic Institute, Khar'kov State University). Sov. Phys.–Crystallogr. 17: No. 6, 1067-1069 (May 1973).

The phase composition and structure of W and Mo films made with controlled composition of the molecular beam and the residual gases have been studied as a function of the evaporation and condensation conditions. It is shown that during the initial stages in thin films made in a vacuum of $P \approx 10^{-7}$ torr the face-centered modifications of W and Mo are formed, due to a size effect. In films prepared during condensation of a molecular beam containing impurity particles (oxides) or at low deposit rates the oxide phases $Mo_2O_3$, $W_3O$, $WO_3$, and the new phase $W_2O_3$ were observed. A new modification of the oxide $WO_3$ with a cubic lattice of the $ReO_3$ type was observed, which went over to the tetragonal modification with increasing film thickness. During deposition of a molecular beam on a carbon substrate with $t_s \geq 500$°C, the carbides $W_2C$ and $Mo_2C$ with hexagonal lattices were observed. (auth)

## Radiation Effects

*Refer also to abstracts 1033, 1909, 2009, 2010, and 2046.*

**1012** MOESSBAUER EFFECT AND X RAYS IN ELECTRON-IRRADIATED INVAR-ALLOYS. Rechenberg, H.; Chamberod, A.; de Tournemine, R. (Univ., Grenoble, France). pp 15 of Hyperfine Interactions Detected by Nuclear Radiation. Liege; Univ. Liege (1973). (In French)

From hyperfine interactions detected by nuclear radiation; Liege, Belgium (11 Sep 1973).

The studies already carried out on the magnetic properties of Invar alloys show the necessity of establishing the correct diagram for iron–nickel. An attempt has thus been made to obtain the equilibrium state for alloys of 30 to 50% nickel by making use of the acceleration of diffusion under irradiation. Moessbauer measurements make it possible to detect two regions in the samples irradiated at ambient temperature, one paramagnetic and the other ferromagnetic. The latter is characterized by a quadrupole coupling that seems to indicate an arrangement of the FeNi type. Furthermore, measurements by x rays show that these two phases have the same structure, fcc, and the same crystalline parameter, which is almost independent of the concentration. These observations can be interpreted by separation into two phases, one richer in nickel, the other richer in iron. It is possible to believe that the tendency toward segregation that must already exist in the initial alloy plays an important role in the magnetic properties. (tr–auth)

**1013** SIMULATED MIGRATION AND REACTION OF CORRELATED POINT DEFECTS. Thompson, L.; Sosin, A. (Univ. of Utah, Salt Lake City). Radiat. Eff.; 19: No. 2, 109–118(Jun 1973).

Monte Carlo techniques are applied to defect migration in the vicinity of a fixed reaction volume. Intended to simulate "stage $I_D$" annealing of correlated interstitials and vacancies in fcc metals, large reaction spheres of up to 720 atomic volume are employed, with mobile defects in the ⟨100⟩ split configuration symmetrically diffusing from maximum distances of more than twice the capture radius $r_0$ and for a maximum of 100 jumps. This discrete approach and continuum theory are judged to be equally valid. Random walk recovery probabilities are not a smooth function of initial distance r, but for large reaction volumes agree with continuum theory nearly as well for $r \sim r_0$ as for $r > 2r_0$. Absolute agreement is improved as the "dumbbell" separation of the split defect is increased. Recovery due to an extended distribution of defects is obtained by weighting individual walks from distances $\leq 3r_0$: the resulting composite annealing curves disallow observation of structure and compare favorably with resistivity data. The number of symmetric random walk jumps N required to reach the maximum rate of correlated recovery - the "$I_D$ peak" - is found for a wide range of initial distributions, the best parameter estimates for Cu giving $N = 50 \pm 15$. This value and resistivity data give N for the uncorrelated recovery peak in agreement with theory. One dimensional migration is excluded by these results. (auth)

**1014** STAGE II RECOVERY OF ELECTRON-IRRADIATED DILUTE COPPER ALLOYS. Dworschak, F.; Kraut, A.; Sonnenberg, K.; Wollenberger, H. (Kernforschungsanlage, Juelich, Ger.). Radiat. Eff.; 19: No. 2, 119–121(Jun 1973).

The influence of impurities on Stage II recovery has been studied in nine different dilute copper alloys irradiated at 60 K with 3-MeV electrons. An interpretation of the recovery substage at 110 K is discussed that is consistent with the results from recovery as well as damage rate measurements. (auth)

**1015** INFLUENCE OF RADIATION DAMAGE ON LATTICE LOCATION AND HYPERFINE INTERACTION IN Yb-IMPLANTED IRON. Thome, L. (Univ., Paris); Chaumont, J.; Bernas, H.; Cohen, C.; Bruneaux, M.; Abel, F. (Univ., Paris). pp 14 of Hyperfine Interactions Detected by Nuclear Radiation. Liege; Univ. Liege (1973).

From hyperfine interactions detected by nuclear radiation; Liege, Belgium (11 Sep 1973).

Integral perturbed angular correlation measurements in implanted FeYb alloy annealed up to 600°C are compared with channeling experiments in the same alloy. The hyperfine fields of $^{175}$Lu and $^{169}$Tm (parent nuclei $^{175}$Yb and $^{169}$Yb respectively) in Fe fall rapidly to zero at an annealing temperature of 500°C. The normalized scattering yield $\tau$ for 1.6 MeV $^{14}$N ions in Yb is of the order of 0.55 in the main channeling directions (axes and planes) at room temperature, in agreement with measurements of other groups. Upon annealing, the variation of $\tau$ for all directions except (100) plane parallels that of the hyperfine field, but $\tau$ does not fall to zero: above 500° C, $\tau$ is about 0.17. For the (100) plane, $\tau$ is systematically higher than in the other directions. The significance of $\tau$ in terms of a "substitutional fraction" will be discussed; it is suggested that lattice distortions around the impurity could affect $\tau$ considerably. The channeling results obtained around 500° C indicate that the Yb ions interact with the vacancy loops produced by implantation. The hyperfine field results show that the Yb ions precipitate. The latter effect was studied via a differential perturbed angular correlation experiment on the 36 ns level of $^{169}$Tm in the annealed (550° C) FeYb alloy. A pure electric quadrupole interaction was found with a frequency distribution of width $\sim$0.15, in agreement with the suggested precipitation mechanism. (auth)

**1016** ELECTRON-IRRADIATION STUDIES IN COPPER. Youngblood, G. E. Salt Lake City; Univ. of Utah (1973). 146p. University Microfilms Order No. 73-23,116.

Thesis (Ph. D.).

Irradiation of metals with $\approx 1$ MeV electrons produces simple Frenkel defects. The defects are largely correlated, energetically or spatially; one of the pair of point defects (i.e., interstitial or vacancy) can be thermally activated by warming until it may recombine with its partner, restoring the lattice in the local region to its original undamaged condition. Some of the remaining fraction of defects, however, escape their correlated partner and randomly migrate through the lattice sampling the interaction potential at each site. The concern in this work is the identification of the migrating defect and possible reactions assigned to it in a temperature range high enough ($\gtrsim 80$°K) so that correlation is essentially eliminated from consideration. In particular, the long-standing controversy between the one-interstitial and the two-interstitial model advocates are examined. The thermal conversion process, an interstitial-phenomena peculiar to the two-interstitial model, should enhance the damage rate in some characteristic temperature region and for some characteristic background defect density. Analysis of damage rates in pure copper over a temperature range of 80 to 220°K and up to defect concentrations of ≈1 ppM failed to reveal any resolvable evidence for the thermal conversion process. These results are compared with recent contrary evidence from internal friction experiments. The reciprocal damage rate (RDR), a function inversely proportional to an "effective trapping concentration" and, therefore, extremely sensitive to the relative concentrations of vacancies and interstitial traps, was determined for 1.5 MeV "analysis irradiations" at ≈80°K for high-purity copper. An analysis irradiation at ≈80°K was performed after each step of an isochronal annealing schedule through the stage III temperature region in pure copper that had been preirradiated at 80°K and at 4°K. The conclusion that vacancies migrate in stage III and partially disappear at fixed sinks best explains these data. (Diss. Abstr. Int., B)

**1017** NATURE AND THERMAL STABILITY OF DEFECTS IN NEUTRON-IRRADIATED Mo AND Mo−0.5% Ti. Volumes I and II. Sikka, V. K. Cincinnati; Univ. of Cincinnati (1973). 416p. University Microfilms Order No. 73-22,638.

Thesis (Ph. D.).

The as-irradiated microstructure formed during the fast-neutron irradiation of molybdenum and molybdenum−0.5% titanium at temperatures in the range of ~70 to 1000°C and fast neutron fluences of $4.2 \times 10^{19}$ (ETR) to $\sim 1 \times 10^{22}$ (EBR-II) n $cm^{-2}$ ($E > 1$ MeV), was characterized using the transmission electron microscope. The effects of neutron irradiation on the physical and mechanical properties were studied using electrical resistivity, bulk density, and microhardness. The as-irradiated microstructure is classified into black spot clusters, dislocation loops, rafts, and voids. The raft formation occurred in the temperature range of ~70 to 500°C. A fast neutron fluence of $1.1 \times 10^{20}$ n $cm^{-2}$ ($E > 1$ MeV) is shown to be the threshold fluence for raft formation at ~70°C. Threshold temperature for void formation is shown to be as low as 0.19 to 0.24 $T_m$. Voids were observed to form a three-dimensional bcc void lattice. The ordered void lattice decreases linearly with increasing irradiation temperature, and thus is suggested as a temperature monitoring device in the reactor. The effect of 0.5% titanium addition to molybdenum is to increase the temperature for ordered void formation and to decrease the ordered void lattice parameter. The various recovery stages observed in the microhardness curves as a function of annealing temperature were characterized by transmission electron microscope observations. The black spot clusters are found to exist at temperatures <700°C (0.34 $T_m$), loops <1200°C (0.51 $T_m$) and voids <1450°C (0.6 $T_m$). The void annealing is explained by the bulk-diffusion mechanism. The ordered void lattice parameter and the void density are shown to be a sensitive function of the displacement rate. All the void data reported in the literature are corrected to the displacement rate used in this investigation. The significant effect of the ordered void lattice formation is to saturate the void volume swelling to ~1%. (Diss. Abstr. Int., B)

**1018** FAST-NEUTRON SPUTTERING OF IRON AT VARIOUS TEMPERATURES. Baer, T. S. Cincinnati; Univ. of Cincinnati (1973). 107p. University Microfilms Order No. 73-22,827.

Thesis (Ph. D.).

The fast-neutron sputtering ratio for iron was measured in the temperature range from 390 to 650°F in a vacuum. The measured values range between $(3.48 \pm .88) \times 10^{-3}$ and $(7.47 \pm 2.4) \times 10^{-3}$ atoms per neutron. The values are in agreement with a previously measured value near room temperature. The measured values are significantly higher than predicted by the various models for sputtering. Five random models for neutron sputtering are discussed including a multigroup diffusion model. One ordered model for neutron sputtering is discussed and arguments are presented in favor of using an ordered sputtering model for polycrystalline neutron sputtering calculations. The effect of the surface displacement energy on the theoretically calculated sputtering ratios is discussed. The construction of the apparatus, the experimental methods used, and the dosimetry methods used to determine the sputtering ratios are presented in detail. No significant temperature dependence for the sputtering ratio was found in the temperature range investigated. Theoretical models suggest a temperature relationship but not a strong one. (Diss. Abstr. Int., B)

**1019** LOCALIZED VIBRATIONAL MODES FOR IMPLANTED OXYGEN IN GERMANIUM. Stein, H. J. (Sandia Labs., Albuquerque, NM). J. Appl. Phys.; 44: No. 6, 2889-2890(Jun 1973).

The first observation of localized vibrational modes for an implanted ion in Ge is reported. The localized mode for interstitial oxygen at 856 $cm^{-1}$ and additional weak oxygen-associated absorption bands between 700 and 850 $cm^{-1}$ were observed by infrared absorption following oxygen implantation at 200°C. Infrared detection of the vibrational modes for oxygen implanted into Ge at room temperature is precluded by ion-induced disorder and by absorption presumably associated with free carriers in the implanted layer. (auth)

**1020** OSCILLATING TRAJECTORIES IN PLANAR CHANNELLING STUDIED IN A DOUBLE ALIGNMENT CONFIGURATION. Gaillard, M. J.; Poizat, J. C.; Remillieux, J. (Univ., Lyon). Phys. Lett.; 45A: No. 4, 325-326(8 Oct 1973).

The scattering yield of protons measured in a particular configuration of planar double alignment from a thin gold crystal exhibits strong oscillations when the incident energy varies, providing a new method of observation of particle trajectories in planar channeling. (auth)

**1021** INFLUENCE OF ELECTRON IRRADIATION ON PROGRAM LOADING EFFECT OF FCC METALS WITH VARIOUS PACKING DEFECT ENERGIES. Gindin, I. A.; Dyatlov, V. P.; Neklyudov, I. M. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 7, 1117-1120(Jul 1973). (In Russian).

A study was made of the influence of electron irradiation on the programme loading effect of copper, nickel, and aluminum. The increase of the yield point in elongation after the irradiation-mechanical effect is shown to rise with a growth in stacking fault energy. (auth)

**1022** EFFECT OF HIGH-ENERGY-PARTICLE IRRADIATION ON LOW TEMPERATURE TEMPERING OF MARTENSITE CARBON STEEL. Kritskaya, V. K.; Kurdyumov, G. V.; Il'ina, V. A. (Inst. of Metallurgy Science and Physics of Metals, Moscow). Dokl. Akad. Nauk SSSR; 211: No. 3, 577-579(21 Jul 1973). (In Russian).

Martensite carbon steel was irradiated with fast electrons ($10^{18}$ to $10^{19}/cm^2$) and neutrons ($\sim 10^{15}/cm^2$) and allowed to stand 2.5 or 6 years at room temperature. X-ray examination of the samples showed that, as indicated by the 011-110 doublet separation, the martensite structure disintegrated much more slowly in the irradiated samples than in the controls. The increased stability of the tetragonal lattice of irradiated martensite is explained by the presence in the crystal lattice of a high concentration of radiation-induced defects, which interact with c atoms to prevent destruction of the solid solution. Thus the rate of diffusion transport of c is decreased, with an increase in the probability of formation and growth of carbide centers. (TTT)

**1023** ANISOTROPY OF THE ENERGY SPECTRA OF ELECTRONS EMITTED AS A RESULT OF PROTON BOMBARDMENT OF MOLYBDENUM. Begrambekov, L.B.; Zhdanov, S.K.; Tel'kovskii, V.G. (Moscow Engineering Physics Institute). Sov. Phys.-Solid State 14: No. 12, 3075-3076 (June 1973).

The processes responsible for electron emission were investigated by measuring the energy spectra of the electrons emitted along different directions from a polycrystalline molybdenum target bombarded with 20-40 keV protons. (CES)

## Other Materials

*Refer also to abstracts 468, 2368, 2400, and 2408.*

**1024** (BNWL-B-288) PROJECTION OF GRAPHITE BEHAVIOR IN THE UNIVERSITY OF WISCONSIN TOKAMAK (AUSTIN DESIGN). Gray, W. J.; Morgan, W. C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)), Jun 1973. Contract AT(45-1)-1830. 40p. Dep. NTIS $4.00.

An estimate was made of the graphite performance in the University of Wisconsin Tokamak (Austin Design) described by Abdou et al. The neutron spectra in the graphite for this design provided by Abdou were related to the "equivalent fission fluence for damage in graphite" using group average displacement cross sections provided by Jenkins who used in turn the Thompson and Wright form of the atomic displacement weighting function. Graphite temperatures were calculated using heat generation rates supplied by Abdou et al. Dimensional changes were determined for the Wisconsin reactor using data for type NC8 graphite. The neutron flux in the graphite region is relatively low. As a result, NC8 graphite, which is a typical nuclear graphite, could be expected to last more than 6900 full power operating days based on considerations of unstressed dimensional changes. Internal stresses due to the flux gradient in the graphite could reduce this lifetime somewhat. Graphite was shown to be considerably better than lithium for fast neutron attenuation; therefore the lithium blanket should be reduced to the minimum thickness required for tritium breeding, and graphite be used for neutron moderation. (9 figures, 10 tables, 13 references) (DLC)

**1025** (BNWL-B-289) PROJECTION OF GRAPHITE BEHAVIOR IN THE LASL REFERENCE THETA PINCH REACTOR. Gray, W. J.; Morgan, W. C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jun 1973. Contract AT(45-1)-1830. 35p. Dep. NTIS $4.00.

An estimate is made of the graphite performance in the LASL Reference Theta Pinch Reactor (RTPR) described by Burnett et al. and by Dudziak. The neutron spectra in the graphite for this design provided by Dudziak were related to the "equivalent fission fluence for damage in graphite" ($\Phi_C$) using group average displacement cross sections provided by Jenkins who used, in turn, the Thompson and Wright form of the atomic displacement weighting function. Graphite temperatures were calculated using heat generation rates supplied by Dudziak of LASL. Dimensional changes were determined for the RTPR using data for types NC8 and 9640 graphites. The calculated neutron fluences are quite high in the graphite region of the RTPR. As a result, dimensional changes in the graphite will occur rather rapidly such that the lifetime of the graphite will probably be limited to something less than 300 full power days unless a much improved graphite can be produced. Alternatively, some design changes could be considered and a few possibilities along this line were discussed. Heat generation rates in the graphite region of the RTPR are also quite high leading to fairly large calculated temperature gradients. If these gradients are not eliminated by cooling channels, they will tend to produce thermal stresses and radiation-induced stresses. (8 figures, 10 tables, 18 references) (DLC)

**1026** (CEA-R-4502) STUDY OF AMORPHIZATION OF A Pd-Si ALLOY BY IRRADIATION. Lesueur, D. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Oct 1973. 120p. (In French). Dep. NTIS (U. S. Sales Only) $8.00.

Thesis. Submitted to Paris Univ., France.

A palladium–20% silicon alloy can be obtained in an amorphous state by rapid quenching from the melt. Mechanical properties and thermal dilatation of the amorphous alloy are quite similar to those of "normal" crystalline metallic phases. On the contrary, atomic structure and resistivity are similar to those of liquid metals or alloys. Results show that the amorphous state is not unique. The amorphization of crystalline Pd–Si alloy by $^{235}$U fission fragments is studied. Each fission fragment makes amorphous a certain volume, which is $2 \times 10^{-17}$cm$^3$ at 400°K and $9 \times 10^{-17}$cm$^3$ at 20°K. It is shown that the amorphization of such an alloy is due to atomic collisions between the incident particle and the atoms of the target and also to the excitation of electrons along the path of the particle. Electronic excitation produces a "thermal spike", i.e. a local rise of temperature in the sample. This phenomenon induces sputtering at the sample surface and bulk amorphization. Another consequence of this "thermal spike" is the existence of an "unannealed volume", i.e., a region in which a local reordering takes place. Such a model can exist in a metallic substance only if there is partially covalent bounding. (auth)

**1027** (ORNL-TM-4308) DENSITY AND VISCOSITY OF SEVERAL MOLTEN FLUORIDE MIXTURES. Cantor, S. (Oak Ridge National Lab., Tenn.). Mar 1973. Contract W-7405-eng-26. 33p. Dep. NTIS $3.75.

Using a dilatometric method, densities were determined for the following molten salts: $LiF-BeF_2$ (66-34 mole %), $LiF-BeF_2-ThF_4$ (70.1–23.9–6.0, 70–18–12, 70–15–15 mole %), $LiF-BeF_2-ZrF_4$ (64.7–30.1–5.2 mole %), $LiF-BeF_2-ZrF_4-UF_4$ (64.79–29.96–4.99–0.26 mole %), $NaBF_4-NaF$ (92–8 mole%), and $KNO_3$. For the fluorides, molar volumes obtained from the density measurements agreed within 2% with volumes calculated from additive contributions of the components. The expansivities of three $LiF-BeF_2-ThF_4$ mixtures were practically identical, $2.5 \times 10^{-4}$/°C. Density–temperature curves from 25 to 700°C for $LiF-BeF_2-ThF_4$ (72–16–12 mole %) and for $NaBF_4-NaF$ (92–8 mole %) were derived from room-temperature pycnometric determinations and from estimated expansivities of the solid salts. Viscosities of three salt mixtures were determined by oscillating-cup methods: $LiF-BeF_2-ThF_4$ (72.7–15.7–11.6, 70.1–23.9–6.0 mole %) and $NaBF_4-NaF$ (92–8 mole %). The viscosities of the $LiF-BeF_2-ThF_4$ melts were analogous to viscosities of similar mixtures containing $UF_4$ instead of $ThF_4$. (auth)

**1028** ANALYSIS OF COMPLEX THERMOLUMINESCENCE GLOW CURVES. Onnis, S.; Rucci, A. (Univ. Cagliari, Italy). J. Lumin.; 6: No. 5, 404-413(Aug 1973).

A method for analyzing complex thermoluminescence glow curves is reported. It allows the fitting of the experimental curves with the proposed kinetic equations in such a way as to verify their capability to represent the process under examination. The values of activation energy, frequency factor, and other relevant parameters can be obtained. An application is made to the glow curve of NaCl x-irradiated at room temperature. (22 references) (auth)

**1029** PHOTOCONDUCTIVITY AND PHOTO-HALL-EFFECT IN $\gamma$-IRRADIATED ALKALINE ICE. Eisele, I. Munich; Technische Univ. (1972). 135p. (In German).

Thesis.

Electrons were caught in traps in $\gamma$-irradiated alkali ice (10M NaOH) at a temperature of 77°K. The temperature dependence of the photoelectric current produced between 4 and 120°K and the agreement of the wavelength dependence of the photoelectric current with the absorption band show that there is no stable excited energy state for the electron in the trap. The traps have an average depth of 0.048 eV and indicate lattice deformations due to the presence of $O^-$ ions. For highly resistant materials, an apparatus was developed for measuring the Hall movement in which the sample rotates in a magnetic equilibrium field and an interrupted light beam procedures the moving electrons. A phase and frequency-sensitive measuring method enabled the true, free from interference Hall signal, which occurs in the total frequency of both modulations, to be measured. The hall movement of the photoexcited electrons on alkali ice has a value of $\mu_{Hall} = 4.7 \pm 2.3$ cm$^2$ v$^{-1}$ sec$^{-1}$ at a temperature of 83°K. The temperature dependence of the Hall movement was measured between 80 and 130°K. (GE)

**1030** TEMPERATURE COEFFICIENT OF PYROGRAPHITE SURFACE FREE ENERGY. Kostikov, V. I.; Kharitonov, A. G. (Moscow Inst. of Steel and Alloys). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 11, 16-17(1972). (In Russian).

By measuring the change in geometric parameters of cracks formed as a result of annealing, using the mathematical method of I. V. Obreimov, the temperature coefficient of free surface energy of basic-density pyrographite was measured in the interval 20 to 2300° C. (tr-auth)

**1031** ENERGY TRANSFER MECHANISMS ON SOME $\gamma$-IRRADIATED SYNTHETIC ZEOLITE SURFACES. Wong, P. K. (Brookhaven National Lab., Upton, NY). Radiat. Eff.; 19: No. 2, 87-92 (Jun 1973).

The trapped paramagnetic centers in four $\gamma$-irradiated zeolites was examined by ESR spectroscopy. The centers in NaA, NaX, and NaY are identified as trapped holes away from substituent $Al^-$ ions; in CaA, trapped holes adjacent to $Al^-$ ions. Electron scavengers added to the zeolites prior to the irradiation do not affect these centers, and no anion radicals are observed at 77° K. On the contrary, electron donors prevented the formation of these trapped holes and some radicals and cation radicals are produced, leading to the conclusion that there is energy transfer on the surfaces of the four zeolites tested, similar to the surface of silica under the same conditions. This hypothesis can be used to account for the radiolysis products of pentane and carbon dioxide on molecular sieves and silica gel. (auth)

**1032** $\gamma$-RADIOLYSIS OF LiF. Van den Bosch, A. (Centre d'Etude de l'Energie Nucleaire, Mol, Belg.). Radiat. Eff.; 19: No. 2, 129-133(Jun 1973).

Data are reported of optical absorption, magnetic susceptibility, mass, and mass density measurements, which were carried out on $\gamma$-irradiated single crystals of lithium flouride. The results show that the radiation damage in the $\gamma$-irradiated samples is strikingly similar to that in the neutron-irradiated specimens. A quantitative observation, however, reveals differences that give experimental evidence for the statement that the F-centres occur in a more aggregated form in the gamma- than in the neutron-irradiated crystals. (auth)

**1033** IMPLANTATION PROFILES MODIFIED BY SPUTTERING. Krimmel, E. F.; Pfleiderer, H. (Siemens AG, Munich). Radiat. Eff.; 19: No. 2, 83-85(Jun 1973).

The impurity profiles obtained by ion implantation may be seriously affected by simultaneous sputtering. Saturation conditions are easily achievable in the case of sufficient sputtering yield. A numerical study is made on the basis of a previous model using a simple penetration distribution function. The accordance with experimental results is promising. (auth)

**1034** ELECTRICAL PROPERTIES OF SILICON IMPLANTED WITH BORON IONS OF MeV ENERGY. Kostka, A.; Kalbitzer, S. (Allgemeine Elektricilaets–Gesellschaft AEG Telefunkem Heilbronn, Ger.). Radiat. Eff.; 19: No. 2, 77-82(Jun 1973).

Buried $p^+$-type layers were produced in silicon substrates by implanting boron ions of 3 or 8 MeV with doses of $10^{12}$ to $3 \times 10^{14}$ cm$^{-2}$. Experimental techniques such as junction staining and capacitance–voltage and electrical sheet measurements were used to evaluate carrier concentration profiles, electrical activity, and effective mobility of the buried layers as a function of temperature in the range of 350 to 1000° C. (auth)

**1035** PRECIPITATION OF BORON ATOMS IMPLANTED IN SILICON AS DETECTED BY CHANNELING ANALYSIS. Akasaka, Y.; Horie, K. (Mitsubishi Electric Corp., Amagasaki, Japan). J. Appl. Phys.; 44: No. 7, 3372-3374(Jul 1973).

The precipitation of boron atoms in a silicon crystal that had been heavily implanted with boron ions at room temperature and then postannealed at high temperatures was studied by channeling analysis of the $\alpha$ particles induced by the $^{11}B(p,\alpha)^{8}Be$ nuclear reaction. It was found that boron atoms that exceed the solubility limit precipitate on $\langle 110 \rangle$ strings in the region of the highest boron concentration (around the boron ion range) with a lattice distance somewhat different from that of the host crystal after annealing at 900°C. (auth)

**1036** CHARGE BUILDUP IN ELECTRON-IRRADIATED DIELECTRICS. Gross, B. (USP, Sao Carlos, Brazil); Dow, J.; Nablo, S. V. J. Appl. Phys.; 44: No. 6, 2459-2463(Jun 1973).

Irradiation of dielectrics with nonpenetrating electron beams generates long-lasting space charges. A simple experimental and mathematical method is developed for the investigation of charge buildup during irradiation. Time-resolved charge measurements carried out with pulsed beams of 1-MeV electrons, pulse duration of $4 \times 10^{-6}$ sec, and an average current density of $10^{-2}$ A/cm$^2$ were used to analyze effects of charge leakage caused by radiation-induced conductivity and electron range reduction caused by retardation of the incident electrons in the internal space-charge field. Leakage is found to predominate in silica and borosilicate glass while range reduction predominates in polyethylene. (5 figures, 2 tables, 22 references) (auth)

**1037** OPTICAL STUDY OF LITHIUM-DEFECT COMPLEXES IN IRRADIATED SILICON. Chen, C. S.; Corelli, J. C. (Rensselaer Polytechnic Inst., Troy, NY). J. Appl. Phys.; 44: No. 6, 2483-2489(Jun 1973).

Optical spectroscopy was used to study the interaction of lithium impurity atoms with neutron-produced defects in silicon. In addition to the divacancy-associated defect absorption bands at 1.8, 3.46, and 3.61 $\mu$, several additional radiation-produced infrared absorption bands at 1.36, 1.50, 1.6, 1.94, 2.05, 2.09, 2.14, and 2.4 $\mu$ are observed in lithium-doped silicon, irrespective of the oxygen concentration. In high oxygen concentration Si, a decrease of the $(LiO)^+$ vibrational band (9.85 $\mu$) accompanied by an increase of the oxygen interstitial vibrational band (9 $\mu$) is observed after neutron irradiation (at ~300°K) and heat treatment (to ~150°C). This fact rules out the possibility of the formation of the Li–O–vacancy defect complex. The presence of Li decreases the production of the oxygen–vacancy complex. The intensity and annealing temperature of the divacancy-associated bands strongly depend upon the Li concentration, and the intensity is found to be substantially lower than that observed for Si not containing Li. The Li defect bands exhibit a saturation in their intensity for $(Li) \approx 6 \times 10^{16}$ cm$^{-3}$. The bands increase in intensity after $T \gtrsim 80°C$ heat treatment. This is attributed to the dissociation of other simple Li-associated defects. Results indicate that higher-order defect complexes are responsible for the bands and the divacancy must be directly involved in the formation of at least one of them. Detailed annealing studies are presented. (11 figures, 24 references) (auth)

**1038** DEFECTS GENERATED BY X RADIATION IN KCl CRYSTALS. Gorbenko, P. K.; Kovtun, A. A.; Ezhov, N. M.; Telyatnik, A. I. (Kiev Polytechnical Inst.). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 7, 1069-1074(Jul 1973). (In Russian).

A complex study of defect properties was performed in KCl crystals. Mutual transformation of $V_3 \rightleftharpoons V_F$ centers is shown. It is established that at temperatures close to room, one F band in the spectrum of roentgenized crystals is completely decolored by light, and the hole $V_3$-band is slightly changed. In crystals with decolored F band, there appear three thermoluminescence peaks (413, 441, 500°K) instead of one (453°K) in the spectra of fresh-stained crystals and EPR spectrum is observed. The spectrum consists of seven lines. It follows from the spectrum angular dependence that the paramagnetic center symmetry axis coincides with the crystal directions [110]. On the basis of the data on EPR and thermoluminescence of KCl crystals roentgenized at room temperature, the conclusion is drawn that decoloration of F band results from displacement of F centers and their joining with the interstitial ions of the alkali, haloid, and neutral pairs. Appearance of these defects follows from the character of F and $V_3$ centers accumulation and the law of crystal electroneutrality. The paramagnetic center model is suggested representing a neutral interstitial atom of potassium, paramagnetic electron of which is also localized on the chlorine ion nucleus, and haloid vacancy which are arranged in the direction [110] of the crystal. 6 figures. (auth)

**1039** CHANGE IN THE STRUCTURE OF GLASS-LIKE ARSENIC TRISULPHIDE AND TRISELENIDE UNDER THE INFLUENCE OF PENETRATING RADIATION. Poltavtsev, Yu. G.; Pozdnyakova, V. M. Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 6, 1150-1152(Jul 1973). (In Russian).

An x-ray study was performed for glass-like $As_2S_3$ and $As_2Se_3$ subjected to $^{60}Co$ $\gamma$-radiation ($10^8$R). Irradiation of glass-like $As_2S_3$ is shown to change its structure towards the structure of a crystal. The first coordination number of irradiated $As_2Se_3$ is larger than that in the initial glass-like samples. (auth)

**1040** INFRARED–ABSORPTION STUDY OF RADIATION DEFECTS IN SILICON BOMBARDED WITH LITHIUM IONS. Baranova, E.K.; Gusev, V.M.; Strel'tsov, L.N. (I. V.Kurchatov Institute of Atomic Energy, Moscow). Sov. Phys.–Semicond. 6: No. 12, 2009-2010 (June 1973).

**1041** IMPLANTATION OF ANTIMONY IONS INTO DIAMOND. Vavilov, V.S.; Gukasyan, M.A.; Konorova, E.A.; Milyutin, Y.V. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. Phys.–Semicond. 6: No. 12, 1998-2002 (June 1973).

Electrical properties of diamond layers containing implanted antimony atoms were investigated. The implantation was carried out at 800°C. Electron–diffraction studies showed that post–implantation annealing restored the original crystal structure. In contrast to layers containing implanted phosphorus and arsenic atoms, the electrical conductivity of antimony–doped layers increased in the course of annealing at temperatures up to 1400°C. Implantation of boron and antimony into diamond produced p–n junctions, which indicated that the layers doped with antimony had n–type conduction. The low values of the Hall emf (mobility below 1 cm$^2 \cdot V^{-1} \cdot sec^{-1}$), the strong dependence of the conductivity on the implanted–ion dose, and the sign of the thermoelectric power corresponding to p–type conduction indicated that hopping of carriers occurred in layers containing from $(2\text{-}3) \cdot 10^{14}$ to $10^{15}$ cm$^{-2}$ of the implanted ions. (auth)

**1042** COLORATION OF $PbF_2$ CRYSTALS BY IRRADIATION AND THEIR ELECTRICAL PROPERTIES. Arkhangel'skaya, V.A.; Erofeichev, V.G.; Kiseleva, M.N. Sov. Phys.–Solid State 14: No. 12, 2953-2955 (June 1973).

Pure and rare–earth–activated $PbF_2$ crystals exhibited a relatively high conductivity ($\rho \sim 10^6$–$10^7$ $\Omega \cdot$ cm). A study of the Hall effect indicated that this conductivity was of n type. The rate of coloration of $PbF_2$ by $\gamma$ rays was anomalously high, compared with other crystals in the homologous series of fluorite. The nature of the color centers in $PbF_2$ was deduced from a study of the absorption and the ESR spectra of the irradiated crystals. (auth)

**1043** TEMPERATURE DEPENDENCE OF DISLOCATION MOBILITY IN GAMMA IRRADIATED ($10^7$ RAD DOSE) NaCl CRYSTALS. Ermakov, G.A.; Nadgornyi, E.M. (Institute of Solid State Physics, Academy of Sciences of the USSR, Chernogolovka). Sov. Phys.–Solid State 14: No. 12, 2962-2966 (June 1973).

The screw dislocation velocity dependence $\vartheta$ (at velocities $\theta < 1$ cm/sec) on applied shear stress $\tau$ and temperature T was studied in the 100–300°K range for NaCl crystals irradiated with $10^7$ rad gamma rays, corresponding to the initial formation stage for radiation defect accumulations. It was found that $\vartheta$ $(\tau,T)$ decreased with decreasing temperature according to an equation of the type $\vartheta = v_0 \exp(-\Delta W/kT)$ with $v_{0'} = 10^7$ cm/sec and activation enthalpy $\Delta W$, decreasing nonlinearly with $\tau$ in the limits 0.2–0.7 eV. Such a dependence describes a thermally activated process for the potential barriers produced by the irradiated point defects. It is concluded that the probable braking obstacles in irradiated crystals are accumulations consisting of several anisotropic interstitial defects of the H–center type oriented in the [110] and [111] directions. (auth)

**1044** INFLUENCE OF $\gamma$–RADIATION DOSE RATE ON PROPERTIES OF $KH_2PO_4$ CRYSTALS. Burdanina, N.A.; Kamysheva, L.N.; Drozhdin, S.N. (Voronezh State University). Sov. Phys.–Crystallogr. 17: No. 6, 1030-1032 (May 1973).

On the basis of low–frequency measurements of the dielectric permeability and the tangent of the dielectric–loss angle for $KH_2PO_4$ crystals $\gamma$–irradiated with different doses from sources with different powers, we have concluded that the effect of radiation is governed not only by the dose but also by the dose rate: With equal doses, the effect of irradiation increases as the dose rate decreases. (auth)

**1045** EFFECTS OF FROZEN–IN RADIATION–INDUCED RADICALS ON THE FERROELECTRIC BEHAVIOR OF KDP CRYSTALS. Peshikov, E.V. (Institute of Nuclear Physics, Academy of Sciences of the Uzbek SSR). Sov. Phys.–Crystallogr. 17: No. 6, 1033-1036 (May 1973).

It has been found that the dielectric characteristics $\epsilon$ (T) and tan $\delta$ (T) are much affected by $\gamma$ irradiation at 77°K for KDP crystals afterwards annealed in the range from –170 to +40°C. The high $\epsilon$ and the relaxation peak in the loss for the ferroelectric state are suppressed by irradiation because of blocking of the main walls by radiation defects of free–radical type. Annealing is accompanied by monotonic recovery of the $\epsilon$ (T) curves and of the height of the initial tan $\delta$ peak, and also by the occurrence of a new loss peak at intermediate stages of annealing. Annealing to room temperature eliminates practically all the irradiation effects. Both loss peaks are found to be of relaxation type. (auth)

**1046 RADIATION EFFECTS IN NEUTRON-IRRADIATED $LiNbO_3$, $K_2SO_4$, AND $NaNO_3$ SINGLE CRYSTALS.** Kolonstova, E.V.; Kulago, E.E. (M. V. Lomonosov Moscow State University). Sov. Phys.–Crystallogr. 17: No. 6, 1049-1051 (May 1973).

The Laue and diffuse x-ray scattering methods are employed to study neutron-irradiated single crystals of $LiNbO_3$, $K_2SO_4$ (with a fast-neutron irradiation dose of $3.6 \cdot 10^{20}$ neutrons.cm$^{-2}$), and $NaNO_3$ ($3.2 \cdot 10^{17}$ - $7 \cdot 10^{18}$ neutrons/cm$^2$). The observed diffraction effects are interpreted from the standpoint of radiation disturbances ($K_2SO_4$, $NaNO_3$, and $LiNbO_3$), crystal decay ($NaNO_3$), and structural configurational changes ($LiNbO_3$). (auth)

# NUCLEAR MATERIALS AND WASTE MANAGEMENT

## Accountability and Safeguards

*Refer also to abstract 1723.*

**1047** ASSAY OF LIGHT WATER REACTOR RODS FOR THEIR URANIUM-235 CONTENT. Boehnel, K. (Kernforschungszentrum, Karlsruhe, Ger.). Nucl. Technol.; 19: No. 3, 199-201(Sep 1973).

The assay of a light water reactor rod for its fissile uranium content can be accomplished by irradiating the rod in a water bath with neutrons from an antimony-beryllium source. The different slowing down properties of the moderator for neutrons of different energy cause a much stronger attenuation of the source neutron flux than of the flux originating from the induced fissions. At 25 cm from the source, the fission neutrons already contribute 20% to the signal measured by ordinary thermal-neutron detectors, allowing determination of their intensity as a measure of the fissile content of the rod. Laboratory experiments demonstrated that a 30-mCi source is sufficient to attain 1% precision in 1 min. (auth)

**1048** DEVICE FOR NON-DESTRUCTIVELY AND SEPARATELY DETERMINING CONCENTRATIONS OF FISSIONABLE MATERIAL IN A TEST SPECIMEN. Krinninger, H.; Wiesner, S. (to Interatom). Canadian Patent 909,402. 5 Sep 1972. Priority Date 14 Mar 1969, F.R. Germany.

An instrument for the nondestructive determination of the uranium-235 and plutonium-239 content of fuel elements of a nuclear reactor is described. The test specimen is inserted into a lead spectrometer and irradiated by a source of neutrons. This results in production of a pulse of monoenergetic fast neutrons of short duration relative to the slowing-down time of the lead moderator. The number of prompt neutrons produced is determined with a plastic scintillator over different time intervals, according to different mean energies of neutrons slowed by the moderator. The lead shielding provided is adequate to protect the detector against gamma irradiation from fuel that has been irradiated in a reactor. (CA)

## Disposal and Storage

*Refer also to abstract 783.*

**1049** (ICP-1038) PRELIMINARY REVIEW OF ICPP SOLIDS STORAGE HAZARDS. Lohse, G. E. (Idaho Nuclear Corp., Idaho Falls (USA)). Oct 1968. Contract AT(10-1)-1230. 84p. Dep. NTIS $6.25.

High-level radioactive aqueous wastes resulting from the solvent extraction of uranium from nuclear fuel elements are calcined to granular solids in the Waste Calcining Facility at the Idaho Chemical Processing Plant (ICPP). The granular solids are stored in stainless steel bins which in turn are contained inside buried concrete vaults. This arrangement thereby provides double containment and methods for detecting failure of the primary containers, or seepage of surface or ground water through a fissure in the concrete vault. Provisions for retrieval of the solids are included. A critical review of the safety aspects of the ICPP solids storage facilities has been completed. Results indicate that these facilities are capable of withstanding natural phenomena such as earthquakes and flooding, and with proper design elsewhere, that the concept of storing granular solids in bins inside secondary containment is a completely acceptable approach to permanent disposal of highly radioactive waste. Pertinent findings indicate that the reoccurrence of an earthquake of magnitude 7 with an epicenter at Howe scarp 20 miles north of the ICPP would produce a maximum credible ground acceleration at the storage area of 32 percent of gravity. This acceleration would not damage the concrete vault structure, nor do direct damage to the bins. The bin anchor bolts possibly might shear. With anchor bolt failure some damage may be inflicted on bin vent piping above the bins. However release of radioactive solids into the vault or to the environment should not occur. If the ground acceleration is 18 percent of gravity, the maximum probable value, then no damage to the bins, anchor bolts, or piping is anticipated. Climatology and hydrology of the area precludes any major flooding circumstances in the current geological era. If, through some currently inconceivable phenomena, the storage area were to be totally flooded, the stainless steel bins have sufficient corrosion allowance that their integrity should be maintained for at least 500 years. If such a phenomenon were to occur after the integrity of the bins was expended, fission products will have decayed to stable nuclei and only transuranic nuclides would be of concern. The water leach rate of transuranics from calcined solids has been shown to be very low. Adsorption of transuranics by soil materials from the ground and/or surface water would prevent any serious biological hazard to mankind. Mass movement of the regolith is impossible even at sustained wind velocities of 100 miles per hour. Explosion hazards do not appear credible. (auth)

**1050** (ORNL-TM-4233) PROGRAM PLAN FOR THE DEVELOPMENT OF THE BEDDED SALT PILOT PLANT. (Oak Ridge National Lab., Tenn. (USA)). Oct 1973. Contract W-7405-eng-26. 39p. Dep. NTIS $4.00.

A program leading to the establishment in FY 1983 of a pilot plant for storing radioactive wastes in bedded salt is described. The program consists of laboratory and field investigations of factors affecting the suitability of a specific site in southeastern New Mexico; of more generally applicable problems associated with geohydrology and rock mechanics; and of considerations bearing on the operational safety of a pilot plant repository. Tasks concerned with the engineering development and design of the facility are also included. (auth)

## Handling Equipment and Procedures

**1051** (CEA-N-1649) CRITICALITY OF 4% $^{235}$U ENRICHED URANYL FLUORIDE SOLUTIONS. Lecorche, P.; Mangin, D.; Maubert, L.; Revol, H. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France)). Aug 1973. 50p. (In French). Dep. NTIS (U. S. Sales Only) $4.50.

The results of critical experiments with aqueous 4% $^{235}$U enriched solutions in cylindrical and spherical geometries are presented. A 0.548 to 1.084 g/cm$^3$ uranium concentration range was investigated. Various calculations are compared with experiments. Calculations were used to establish a complete criticality table for U(4)O$_2$F$_2$ solutions. (FR)

**1052** (CONF-731101-13) REMOTE MAINTENANCE EXPERIENCE IN THE TRANSURANIUM PROCESSING PLANT AT ORNL. Peishel, F. L.; Evans, W. W.; Matherne, J. L. (Oak Ridge National Lab., Tenn. (USA)). 1973. 22p. Dep. NTIS $3.25.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum and Nuclear Energy Exhibition; San Francisco, California, USA (11 Nov 1973).

Special features to permit remote maintenance and replacement of equipment were incorporated into the Transuranium Processing Plant during initial design in 1962. However, these features were not required initially and were first tested during the summer of 1972. Until then, radiation levels were sufficiently low to permit most maintenance operations to be performed directly by men wearing air suits. Radiation levels increased during 1971 and 1972 due to a processing program for the recovery of large quantities of curium and californium from targets that had been very highly irradiated. These increased levels of both gamma and neutron radiation backgrounds dictated the shielding of equipment in tank pits by water flooding and required that maintenance be done from above through a shield as a routine procedure in most of the plant. Of eight tools developed for remote maintenance, four were demonstrated during the actual maintenance program to be completely adequate; three required slight modification or were rebuilt to make them more versatile or to make them stronger. One tool required complete redesign to fulfill needs demonstrated during the maintenance work. Experience during 1972 showed that the original design concept of ten years ago has resulted in a very successful operating facility from the standpoint of flexibility and maintainability. A short period of maintenance activities during 1973 demonstrated the adequacy of the tools that were developed for remote maintenance. (auth)

**1053** (DP-MS-73-52) ALBEDO METHOD. Application of Neutron Interaction Methods. Clark, H. K. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). [nd]. Contract AT(07-2)-1. 7p. (CONF-731101-2). Dep. NTIS $3.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum and Nuclear Energy Exhibition; San Francisco, California, USA (11 Nov 1973).

The method is applied to the solution of the following problem concerning the storage of fissile materials: Ten 10-in.-diameter, 50-in.-tall cylinders of aqueous solution containing ≤890 g of 5.0% enriched uranium per liter as UO$_2$F$_2$ are proposed to be stored in two rows of five at a square pitch of 20 in. Actual and potential reflectors in the form of walls, floor, ceiling, and personnel will be no closer than 5 in. to the lateral surface of any cylinder and no closer than level with the top and bottom of the cylinders. The cylinder walls are thin enough to be ignored; and walls, ceiling, and floor are equivalent to thick water reflectors. Will this configuration be subcritical? If not, what separation between cylinders is required? (TFD)

**1054** (K-L-6328) SOLID ANGLE-INTERACTION POTENTIAL METHOD: ILLUSTRATIVE PROBLEMS. Newlon, C. E. (Oak Ridge Gaseous Diffusion Plant, Tenn. (USA)). 10 Sep 1973. Contract W-7405-eng-26. 16p. (CONF-731101-11). Dep. NTIS $3.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum and Nuclear Energy Exhibition; San Francisco, California, USA (11 Nov 1973).

The method is applied to determine safe spacings between containers filled with 5% enriched uranium solutions and oxides placed in various configurations. (TFD)

**1055** (LA-UR-73-913) FISSION GAS AND VOID VOLUME MEASURING SYSTEM. Lazarus, M. E. (Los Alamos Scientific Lab., N. Mex. (USA)). [nd]. Contract W-7405-eng-36. 9p. (CONF-731101-9). Dep. NTIS $3.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum and Nuclear Energy Exhibition; San Francisco, California, USA (11 Nov 1973).

A system which provides a measurement of the amount of gas and free void volume contained in encapsulated fuel elements has been in use at LASL for over a year. A gas sample which can be used for mass analysis is also obtained from this system. Using this equipment, the quantity of gas moles released is obtained to better than ±2% and the void volume is determined to better than ± (2 cc + 3% of void volume). (auth)

**1056** STORING OF IRRADIATED FUEL ELEMENTS OR OTHER RADIOACTIVE SUBSTANCE PARTICULARLY FOR NUCLEAR REACTORS. Hyde, J. E. (to Atomic Power Construction Ltd.). German Patent 1,917,689. 22 Oct 1970. Filed date 5 Apr 1969. (In German).

Apparatus for storing irradiated nuclear fuel elements or other radioactive material especially for nuclear reactors, consisting of an elongated container that can be closed hermetically receiving the radioactive material and a cooling tube surrounding the abovementioned container crossed by a coolant assuring the removal of the heat from the outer surface of the wall, is outlined. (TSS)

**1057** DEVICE FOR TRANSFERRING ITEM BETWEEN TWO DEPRESSURIZED ENCLOSURES. Semet, D. (to Commissariat a l'Energie Atomique). French Patent 2,140,277. 8 Jun 1971. 9p. (In French).

An independently operating device for transferring items between two depressurized enclosures, which utilizes the difference between the internal pressure and the pressure outside the glove box, is presented. The device can be used in conjunction with curved passages having radii dependent on the container to be transferred between the enclosures and is suitable for slopes corresponding to rises or descents varying between 0 and 90 deg. A principal movable channel joins the two enclosures. This channel is provided at each of its ends with a cylinder which is outside the enclosure and which leads into the principal channel. A cylindrical part engages in the channel, this part being capable of rotation about the axis of the channel and being provided with an orifice of the same cross section as the cylinder leading into the principal channel. A plug closes the cylindrical part. The container used to transfer the objects from one enclosure to the other has the same diameter as the internal cross section of the principal channel. (FR)

**1058** CRITICAL THREE-DIMENSIONAL ARRAYS OF U(932.2)-METAL CYLINDERS. Thomas, J. T. (Union Carbide Nuclear Corp., Oak Ridge, TN). Nucl. Sci. Eng.; 52: No. 3, 350-359(Nov 1973).

Criticality studies were made of three-dimensional arrays of uranium-metal cylinders enriched to 93.2 wt % in $^{235}$U. Four weight groups of units, ranging from 10.4 to 26.2 kg of uranium in five geometries, were employed to determine the critical surface separation between units as a function of the number in an array. The influence on criticality of hydrogenous neutron reflecting and moderating materials, unit shape, array shape, and of other controlled perturbations to some assemblies was examined. Monte Carlo calculations were performed of the experimental assemblies to confirm the neutron multiplication factors and to interpret the behavior of several subcritical assemblies. The Hansen–Roach neutron cross-section sets reproduce the results of the experiments, in a majority of cases, to an accuracy of ~1% in $k_{eff}$. (auth)

## Transportation

**1059** (BNWL-SA-4753) IMPROVED HEAT TRANSFER FROM RADIOACTIVE WASTE CANISTERS. Jansen, G.; Kaser, J. D. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). [nd]. 3p. (CONF-731101-10). Dep. NTIS $3.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum and Nuclear Energy Exhibition; San Francisco, California, USA (11 Nov 1973).

Since the radioisotope content that can be tolerated in a canister full of radioactive waste is limited by the amount of heat which can be dissipated from the waste to the surroundings, the heat transfer characteristics of a simple cylindrical canister containing only nonmetallic radioactive wastes were compared with canisters having the following design or content modifications: annular canisters; internally finned canisters; canisters with multiple cooling ports; intimately mixed metal-waste composites; and alternate layers of metal and heat-generating ceramic wastes. The cost of fabricating, filling, and handling cylindrical, annular, and internally finned containers was compared. It was concluded that each modification would contribute to improved heat transfer from the waste to the surroundings and that annular and finned containers capable of containing large waste quantities would have a cost advantage over simple cylindrical containers, but that this cost advantage would be offset by an increase in operating costs for filling, shipping, and maintaining the integrity of the larger containers. (LCL)

**1060** (CONF-731105-6) PROBABILITY AND CONSEQUENCES OF ACCIDENTS IN THE NUCLEAR FUEL CYCLE. Shappert, L. B.; Brobst, W. A.; Sisler, J. A.; Langhaar, J. W. (Oak Ridge National Lab., Tenn. (USA); USAEC, Washington, D. C.; Du Pont de Nemours (E. I.) and Co., Wilmington, Del. (USA)). 1973. 19p. Dep. NTIS $3.00.

From winter meeting of American Society of Mechanical Engineers; Detroit, Michigan, USA (11 Nov 1973).

The probability of accidents occurring in the nuclear fuel cycle is examined by considering: projected number of shipments of nuclear materials for power reactors (excluding breeder and gas-cooled reactors); transport by truck, rail, aircraft, and barge; and statistics on the frequency and severity of accidents in each of these modes of transport. The consequences of accidents involving nuclear fuel cycle materials are discussed in terms of package integrity; estimates of radioactivity releases; radiation doses to humans from estimated releases of radioactive materials; and environmental contamination from accidental radioactivity releases. (LCL)

**1061** SOURCE-HOLDER FOR A RADIOACTIVE SOURCE: ITS MANUFACTURE AND THE EQUIPMENT USED FOR THIS PURPOSE. Dufrene, J. L.; Giancana, A.; Lefrancois, J. (to Commissariat a l'Energie Atomique). French Patent 2,147,784. 18 Jun 1971. 13p. (In French).

A new type of $\alpha$ source-holder arrangement is proposed which involves a simple and efficient manufacturing technique and functions in a simple device. This source-holder consists of a lid, a main body, and a membrane. The lid and the main body are in the form of collars having orifices which correspond with the source-holder assembly. The membrane, which closes the orifice, is tightened between two annular gripping edges of the lid and main body respectively provided around their orifices the membrane is brazed onto the annular parts of the lid and the main body situated outside the gripping edges and also onto these edges. The main body and the lid can both carry a chamber in the form of an annular throat situated in the brazed part, each of these chambers being provided with a brazing fuse made of a 72% Ag and 28% Cu eutectic alloy. The membrane, the main body, and the lid may be made of stainless steel. The membrane has a thickness of the order of 6 micrometers. (FR)

**1062** F-144-1 SHIPPING CONTAINER (13 Mar 1972) (ENGINEERING MATERIALS). (Battelle Columbus Lab., Ohio (USA)). (CAPE–2371).

40 drawings.

The F-144-1 Shipping Container is for use in the transportation of unirradiated FFTF and other LMFBR fuel element assemblies or fuel pins. The F-144-1 shipping container can carry one fuel element assembly or up to 120 bundled fuel pins. The assemblies are shipped dry. (auth)

# PARTICLE ACCELERATORS

## Design, Development, and Operation

**1063** (COO-1112-174) NEW ACCELERATOR PROJECTS IN AMERICA. Krisch, A. D. (Michigan Univ., Ann Arbor (USA). Dept. of Physics). [nd]. 28p. (CONF-720640-3). Dep. NTIS $3.50.

From third international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

The NAL Accelerator project is described. Other new accelerator projects including polarized proton acceleration at the Argonne ZGS, the 2.5 GeV electron-positron colliding beams SPEAR, positron-electron-proton (PEP) colliding beams, and the ISABELLE projects are briefly discussed. (WHK)

**1064** (KFK-tr-426) PARTICLE ACCELERATION BY ELECTRON RADIATION. Kolomenskii, A. A. Translated by Rosemarie Corssen from Symposium Ueber Kollektive Beschleunigungsmethoden, Dubna, 27–30 September 1972. (CONF-720952-7). 14p. (In German). Dep. NTIS (U. S. Sales Only) $3.00.

From symposium on collective methods of acceleration; Dubna, USSR (27 Sep 1972).

The six essential methods of collective acceleration of particles by electron radiation are described and discussed. On the one hand, great development potential can be seen in these methods, on the other, their realization still requires extensive theoretical and experimental work. (GE)

**1065** (KFK-tr-428) PRODUCTION OF ACCELERATOR FIELDS BY PRECESSION OF THE MAGNETIC MOMENTS IN FERRITES. Rakityanskii, A. A.; Shenderovich, A. M. (Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Experimentelle Kernphysik). Feb 1973. 7p. (In German). (CONF-720952-6). Dep. NTIS (U. S. Sales Only) $3.00.

From symposium on collective methods of acceleration; Dubna, USSR (27 Sep 1972).

The possibility of constructing a high current induction linear accelerator in which electric eddy current acceleration fields are produced around the vector of the outer magnetic field by excitation of a free precession of the magnetic moment of a ferrite magnetized to saturation was investigated. (GE)

**1066** (SLAC-165) DESIGN REPORT: THE PROPOSED RECIRCULATING LINEAR ACCELERATOR (RLA) AT SLAC. (Stanford Linear Accelerator Center, Calif. (USA)). Aug 1973. Contract AT(04-3)-515. 147p. Dep. NTIS $5.45.

The high energy physics objectives and a general description of the Recirculating Linear Accelerator (RLA) including lattice, orbits, and beam transfer parameters; magnet system; vacuum system; rf system; instrumentation and control; beam switchyard and slow extraction; conventional facilities; and schedule and cost estimates are discussed. RLA's principal parameters may be summarized as follows: A beam energy approximately double that of the present SLAC accelerator would be achieved by a sequence that consists of first-pass acceleration through the two-mile accelerator, beam storage in the recirculator, and reinjection and second-pass acceleration of the beam. In an alternate mode of operation, a stored one-pass beam having an energy up to about 20 GeV could be gradually extracted from the recirculator for use in high duty cycle experiments (up to 7%, as compared with the present 0.06%). The maximum recirculation energy is 17 to 20 GeV, depending on the number of electrons stored. Beam-energy losses of approximately 130 MeV each turn due to synchrotron radiation are compensated by two sectors (200 meters) of standard SLAC accelerator sections operating at the standard accelerator frequency (2856 MHz). These sectors will be powered by a special klystron now under development yielding 500 kW peak power at a duty cycle of about 10%. The repetition rate of the power source is 43,000 pps, and the recirculating period is 23 microseconds, corresponding to the total storage path of 6963 meters. The initial beam energy attainable at SLAC by this method is estimated to be about 42 GeV, and future increases are possible. Some of these would occur naturally as part of the program at SLAC of increases in klystron power. A further substantial change might occur in the future by the installation of accelerator sections which can compensate for the synchrotron radiation loss at storage energies as high as 25 GeV. A combination of these improvements might eventually increase the RLA energy up to 60 GeV. (WHK)

**1067** ELECTROSTATIC ACCELERATOR DEVELOPMENT AT WISCONSIN. Herb, R. G. (Univ. of Wisconsin, Madison). Rev. Brasil. Fis.; 2: No. 1, 17-35(Mar 1972).

From international symposium on nuclear structure; Sao Paulo, Brazil. (8 Nov 1971).

Accelerator facilities for nuclear physics studies at Wisconsin University are presented. The Pelletron of São Paulo University, Brazil, is also described. All major aspects of accelerator components and techniques are reviewed. Further developments, works and plans are also presented. (INIS)

## Auxiliaries and Components

**1068** (BNL-18153) ANALYSIS OF A QUENCH EVENT IN THE 20 IN. Nb−Ti MAGNET MODEL CONSTRUCTED BY G. DANBY ET AL. Cottingham, J. G. (Brookhaven National Lab., Upton, N. Y. (USA)). 15 Aug 1973. 6p. Dep. NTIS $3.00.

Measurements of the voltage and current that resulted from a quench of a superconducting magnet were studied and a simple computer model of this process was developed. Large layer-to-layer voltages were generated by the quench and methods reducing these were suggested and examined. (auth)

**1069** (LA-5404-MS) PROGRAMMING THE MBD MODEL II. Thomas, R. F. Jr. (Los Alamos Scientific Lab., N. Mex. (USA)). Sep 1973. Contract W-7405-eng-36. 18p. Dep. NTIS $4.00.

The LAMPF Microprogrammed Branch Driver (MBD) is described from a programmer's point of view, and a set of macro-instructions implemented in the PDP-11 MACRO assembler, suitable for writing programs for it, is given. The MBD is a small, special-purpose, stored-program processor intended to serve as an interface between a CAMAC branch and a Digital Equipment Corporation PDP-11. (auth)

**1070** (LA-tr-73-44) APPLICATION OF AN INJECTOR-BUNCHER IN A 30 MeV ACCELERATOR. Gass, V. F.; Milovanov, O. S.; Smirnov, I. A. Translated by Anna Vakar from Izv. Vyssh. Ucheb. Zaved., Radioelektron.; 16: No. 1, 104-107(1973). 17p. Dep. NTIS $3.00.

The design of an injector-buncher with a field-emission cathode, and the results of calculation of the beam dynamics of a 30 MeV accelerator with an injector-buncher were investigated. A scheme for a high frequency injector-buncher feed channel is presented. (auth)

## Ion Sources and Injection and Extraction Systems

*Refer also to abstract 1784.*

## Ion Optics and Field Calculations

**1071** (BNL-18259) EFFECT OF A LARGE 0th HARMONIC OCTUPOLE ON STABLE BETATRON OSCILLATIONS. Month, M. (Brookhaven National Lab., Upton, N. Y. (USA)). 20 Sep 1973. 9p. Dep. NTIS $3.00.

The effect of a 0th harmonic octupole (that is, constant in dependence on azimuth) on stable betatron oscillations is treated in smooth approximation. In this approximation, an exact invariant is obtained. Bounded motion results, except when the octupole component is very large. A condition for stability is obtained and, in the case of bounded motion, an expression for the amplitude variation is given. Some comments are made regarding the method of phase averaging. (auth)

**1072** (JINR-P9-7357) IMPEDANCE OF AN ELECTRON RING SCREENED WITH INTERNAL COAXIAL CYLINDER. Aleksakhin, Yu. I.; Sarantsev, V. P. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1973. 22p. (In Russian). Dep. NTIS (U.S. Sales Only) $3.25.

The impedance is calculated for an electron ring in coaxial structures (resonators and waveguides). A possibility is shown to suppress the azimuthal instability at the expense of screening the ring with the internal (coaxial with the ring) tube. (auth)

**1073** (JINR-P9-7412) CALCULATIONS OF THE CENTRAL REGION OF THE U-120M MAGNETIC SYSTEM BY THE GRID METHOD. Alenitskii, Yu. G.; Vorozhtsov, S. B.; Zaplatin, N. L. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 14p. (In Russian). Dep. NTIS (U. S. Sales Only) $3.00.

By the grid method in the two dimensional approximation the distribution of the magnetic permeability in the pole and spiral shims of the central region of the U-120M cyclotron was considered. Based on this fact a semiquantitative explanation of the action of axial gaps in the shims when changing the field level was found. (auth)

**1074** (LA-5332) TRACE: AN INTERACTIVE BEAM-TRANSPORT PROGRAM. Crandall, K. R. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1973. Contract W-7405-eng-36. 23p. Dep. NTIS $4.00.

Instructions are given for using an interactive beam-transport program. Details of the calculations, and a listing of the computer codes, are presented in the Appendixes. (auth)

**1075** (LYCEN-7320) NEW H TYPE STRUCTURE. Comparison With the Interdigital Structure. Chabert, A.; Voisin, G.; Pottier, J. (Lyon-1 Univ., 69—Villeurbanne (France). Inst. de Physique Nucleaire). May 1973. 18p. (In French). Dep. NTIS (U.S. Sales Only) $3.00.

Two kinds of H type structures are compared. The first one, the interdigital H type structure, was already studied extensively in Lyon; and the second one was proposed at Saclay. Measurements indicate that the two structures are quite comparable. (FR)

**1076** (UCRL-Trans-1503) INTENSE ELECTRON BEAM FOCUSING BY LONGITUDINAL FIELD. Plotnikov, V. K. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1972. Translated by G. Brodell (Univ. of California Lawrence Berkeley Lab.), from report ITEF-240. 29p. Dep. NTIS $3.50.

A self-consistent problem is considered for stationary particle distribution functions of intense electron beams focused by a longitudinal magnetic field. The possibility is shown of the existence of stationary solutions for different functions describing the density decrease as a function of beam radius. Analytical expressions for the parameters of consistent-beam and focusing field are obtained for a very large and for a very small density of the beam particles. (auth)

**1077** (UCRL-Trans-1504) PROCESS OF ESTABLISHING TRANSVERSE DIPOLE OSCILLATIONS IN A CIRCULAR BEAM OF CHARGED PARTICLES. Zenkevich, P. R. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1972. Translated by G. Brodell (Univ. of California Lawrence Berkeley Lab.), from report ITEP-951. 34p. Dep. NTIS $3.75.

Free transversal oscillations in a charged particle circular beam are investigated accounting for the particles' frequency spread and collective electromagnetic forces. The possibility of getting information on the beam rotating in the chamber of a circular accelerator, using the experimental study of free dipole oscillations, is considered. (auth)

**1078** (UCRL-Trans-1505) FORMATION OF THE MAGNETIC FIELD OF ACCELERATING UNIT IN THE MODEL OF COLLECTIVE LINEAR ACCELERATOR. Ivanov, G. A.; Mamonov, V. N.; Svetov, L. V. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1973. Translated by G. Brodell (Univ. of California Lawrence Berkeley Lab.), from report JINR-P9-6983. 37p. Dep. NTIS $4.00.

The problems are considered connected with the formation of the magnetic field of the accelerating unit using the solenoid and several systems of gradient coils. The results of calculations of the magnetic field of the leading solenoid and of solenoid parameters are presented as well as a short description of the solenoid and gradient coil construction. Results of the relative magnetic measurements of the solenoid and gradient coil fields are also given. (auth)

**1079** (UJF-2987-F) AVERAGE VALUE OF THE MAGNETIC FIELD IN AN ISOCHRONOUS CYCLOTRON. Kuzmiak, M.; Straka, J.; Hrda, A. (Ustav Jaderne Fyziky, Rez (Czechoslovakia)). Jul 1973. 13p. Dep. NTIS (U.S. Sales Only) $3.00.

The average value of the magnetic field of an isochronous cyclotron was found. A differential equation for the departure of the ion trajectory from the reference circle was solved starting from the motion equation in the median plane of the isochronous magnetic field. (auth)

**1080** INTRODUCTION TO ELECTRON AND ION OPTICS. Dahl, P. New York; Academic Press, Inc. (1973). 152p. $10.50.

An introduction to the theoretical background for electron and ion optical designs is given. The matrix formulation of geometrical optics is used to outline the basic relations. Chapter titles are electron and ion optics, geometrical optics, scaling rules and dispersion coefficients, fields, lenses, analyzers, and space charge and beam production. (WHK)

**1081** SENSITIVITY OF PROTON LINEAR ACCELERATOR STRUCTURES TO PERTURBING EFFECTS. Jule, W. E. III. Amherst, MA; Univ. of Massachusetts (1973). 136p. University Microfilms Order No. 73-22,804.
Thesis (Ph. D.).

The behavior of multi-cell proton linear accelerator cavities was investigated. In particular, the tuning, field flatness, and sensitivity to perturbations for an Alvarez type structure were studied. In addition, the effect of compensation by tuning the structure so as to produce confluence of the two lowest bands was simulated. It is pointed out that such compensated structures are less sensitive to errors but that tuning capabilities are also reduced. Also, field models on which accelerator designs are based are cumbersome to handle. Hence, one wishes to find an equivalent circuit model which will accurately predict the behavior of a structure in the presence of errors. In order to determine how accurately different equivalent circuit models predict the results of perturbations, one needs theoretical or experimental results for comparison. A theoretical field model was used for this comparison. In this model, Maxwell's equations were solved in a non-periodic multi-cell Alvarez type structure which closely resembles a real proton linear accelerator. This model neglects the effects of the rounded corners, the bore hole, and the supporting stems of the drift tubes. The solution involves an infinite determinant and is therefore not amenable to numerical calculations. So, an approximation for the axial electric field was considered which, based on a variational statement of the problem, yields reliable numerical results for the frequency and gap fields. Also, a formulation for an infinite periodic Alvarez type structure which is useful computationally is presented. Three equivalent circuit models are presented and discussed. A model based on the approach of Bevensee is formulated for a general multi-cell structure. This leads to an equivalent circuit model for a periodic structure which is considered in two forms. In the first form, the coupling parameter is independent of frequency and yields a particular equivalent circuit. In the second form, the coupling parameter is generalized to have frequency dependence and a second equivalent circuit is implied. This second form of the circuit is considered for both the zero and $\pi$ modes and yields different circuits for these two cases. The third equivalent circuit considered is a phenomenological one involving inductively coupled resonant circuits. Then, the effects of a perturbation in each of these models was considered, and how to relate the parameters of an equivalent circuit model to those of a field model is discussed. The equivalent circuit models are compared analytically and shown to yield the same predictions for frequency shifts but different predictions for the changes in the gap fields. When the predictions of the equivalent circuit models are compared to those of the multi-cell field model, it is seen that the predictions for the perturbed fields agree best when the dispersion curve is accurately reproduced. This shows the importance of fitting the dispersion curve with great care if reliable predictions for the perturbed fields are to be expected from an equivalent circuit. In addition, it is essential to allow frequency dependence in the coupling parameter in order to achieve a good fit for the dispersion curve. Also, the effect of the proximity of the adjacent passband was investigated. It was found that the perturbed fields are most accurately predicted when the structure is least sensitive to errors. (Diss. Abstr. Int., B)

**1082** PERIODIC SYSTEMS OF QUADRUPOLE LENSES. Kartashev, V.P.; Kotov, V.I.; Rzaev, R.A. Sov. Phys.-Tech. Phys. 17: No. 11, 1864-1866 (May 1973).

The properties of periodic systems of quadrupole lenses are investigated. The most general system, consisting of a sequence of lenses rotated with respect to one another by an angle $\theta$, is considered in the thin lens approximation. Analytic expressions are obtained for the stability limits of such a system and for the lower limit of the acceptance. It is shown that for $\theta=\pi/2$ and for small $\theta$ these expressions go over into the corresponding expressions obtained earlier for the systems used to shape muon beams ($\theta=\pi/2$) and for helical quadrupole lenses. It is shown that the procedure used to calculate the acceptance gives the correct dependence on the system parameters, but underestimates the exact calculations by a factor of 1.5. The equations are used to compare various periodic systems. (auth)

**1083** ACCELERATION BY INTERRUPTION OF AN INTENSE ELECTRON BEAM. Grishaev, I.A.; Shenderovich, A.M. Sov. Phys.-Tech. Phys. 17: No. 11, 1871-1873 (May 1973).

The shock excitation of a resonator caused by the interruption of an intense electron beam is analyzed. Intense electric fields are produced; these fields can be used for the acceleration of charged particles. (auth)

**1084** TRANSIENTS AND LIMITING CURRENT IN A MICROTRON. Kosarev, E.L. (Institute of Physics Problems, Academy of Sciences of the USSR, Moscow). Sov. Phys.-Tech. Phys. 17: No. 10, 1759-1764 (Apr 1973).

The transient regimes of the beam-cavity system in a microtron are investigated. It is shown that allowance for the finite time of formation of the microtron beam (i.e., the time of acceleration from the first to the last orbit) yields a current limit of 100 to 200 mA at an energy of 30 MeV. This effect is particularly significant in sectional continuous microtrons with a large number of orbits. (auth)

**1085** RADIAL STABILITY AND PHASE STABILITY IN THE ALVAREZ LINEAR ACCELERATOR. Zaidin, D.G.; Karpasyuk, V.K. Sov. Phys.-Tech. Phys. 17: No. 11, 1885-1887 (May 1973).

A theoretical analysis and computer simulation of radial motion and phase motion for an Alvarez accelerator with no additional focusing are given. (WHK)

## Storage Rings

*Refer also to abstract 1063.*

**1086** (BNL-18231) RELATIONSHIP BETWEEN THE BEAM-BEAM TUNE SHIFT AND THE NUMBER OF INTERACTION REGIONS. Month, M. (Brookhaven National Lab., Upton, N. Y. (USA)). 13 Sep 1973. 5p. Dep. NTIS $3.00.

The choice of the beam-beam tune shift for one interaction region (the beam-beam limit) is discussed. The effect of multiple crossings is then included. Because of radiation damping for electrons, these considerations are quite different for protons and electrons. Both are treated. (auth)

**1087** (BNL-18255) BRICKWALL EFFECT. Month, M. (Brookhaven National Lab., Upton, N. Y. (USA)). 18 Sep 1973. 11p. Dep. NTIS $3.00.

A quantitative account of the brickwall effect is given. By combining the theory of the resistive wall instability with the theory of a nonuniform incoherent tune shift, it is shown how the brickwall effect manifests itself as a limit on the current tune density (current/tune spread) at some critical stack width. A description of the effect in the CERN ISR is given. It is also shown, by an example, how the limiting current condition can be used in a certain class of storage ring design. (auth)

**1088** (LNF/AOR-2) ADONE OPERATION REPORT, JANUARY 1, 1972–DECEMBER 31, 1972. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati). [nd]. 8p. Dep. NTIS (U.S. Sales Only) $3.00.

Machine operation, shutdown, improvements and modifications, and linac operation are summarized. (WHK)

**1089** INTERSECTING STORAGE RINGS. Duff, B. G. (University Coll., London). Sci. Progr. (Oxford); 61: No. 241, 81-97(1974).

Intersecting storage rings are devices which provide a means of studying collisions between particles moving in opposite directions at very high energies. Such a system produces interactions of particles at very much higher effective energies than can be obtained in conventional accelerators. This article attempts to answer three questions: (1) why is it useful to study particle collisions at higher and higher energies? (2) why use storage rings for such measurements? and (3) what results have been obtained so far? In general, the discussion is restricted to storage rings in which protons are the stored particles, and the illustrations are largely based on the intersecting storage rings complex at the C. E. R. N. Laboratory. (auth)

## Experimental Facilities

*Refer also to abstracts 440, 482, 1616, and 1617.*

**1090** (ANL-8026) ON-LINE COMPUTER FACILITY AND OPERATING SYSTEM COSACS AT THE ANL FAST NEUTRON GENERATOR. Poenitz, W. P.; Whalen, J. F. (Argonne National Lab., Ill. (USA)). Aug 1973. Contract W-31-109-eng-38. 24p. Dep. NTIS $4.00.

An on-line/off-line computer system has been installed at the ANL fast neutron generator (FNG) for on-line data acquisition and storage, and for off-line data reduction and evaluation. An operating system called COSACS has been written specifically for the installation. The present report describes all available hardware and software, but emphasizes those aspects of both that were tailored for this application. The various physical-data channels, both input and output, are discussed with regard to transfer rates, bit formats, and interrupt control. The general relationship and areas of compatibility of COSACS with standard compilers and assemblers are discussed. A complete tabulation is given of operations available under COSACS, together with their input/output formats. (auth)

**1091** (BNL-18292) EXPERIMENTAL INVESTIGATION OF A SUPERCONDUCTING NIOBIUM X-BAND DEFLECTING CAVITY AND SUGGESTIONS FOR THE DESIGN OF THE DEFLECTORS FOR A SUPERCONDUCTING RF BEAM SEPARATOR AT NAL. Aggus, J.; Bauer, W.; Giordano, S.; Hahn, H.; Halama, H. J. (Brookhaven National Lab., Upton, N. Y. (USA)). 12 Sep 1973. 49p. Dep. NTIS $4.50.

Design considerations for a deflecting cavity intended for a superconducting rf beam separator at NAL are reviewed. The design parameters given are based on an investigation of a 7-cell niobium test deflector operating at 8.665 GHz. Peak magnetic field of 740 G, corresponding to a peak electric field of 25 MV/m, and an equivalent deflecting field of 6.9 MV/m were obtained. (auth)

**1092** (COO-1195-265) HIGH EFFICIENCY MUON BEAM. Kirk, T. (Illinois Univ., Urbana (USA)). Sep 1973. Contract AT(11-1)-1195. 17p. Dep. NTIS $3.00.

Aspects of muon beams pertinent to the establishment of an effective nucleon structure facility are discussed and a preliminary design for such a beam at NAL is advanced. The optical properties, duty factor and proton beam source are already able to be sharply specified, but the pion and muon transports need more work to be optimal. It is already clear, however, that efficiency gains of at least 20 can be made and probably factors of 50 or even 100 are not impossible. Beam/halo ratios can probably be raised to 10:1 with proper spoilers. Most important of all, the effective beam time can be raised an order of magnitude over present prospects by establishing a separate source of protons for a muon beam by means of a split or pulsed switch in the present neutrino beam time. (auth)

**1093** (FMI-1000-431) AUTOMATIC THREE-DIMENSIONAL DOSIMETRY IN ELECTRON BEAMS. Lanzl, L. H.; Rozenfeld, M. (Chicago Univ., Ill. (USA). Dept. of Radiology; Franklin McLean Memorial Research Inst., Chicago, Ill. (USA)). [nd]. 6p. (CONF-731012-1). Dep. NTIS $3.00.

From thirteenth international congress of radiology; Madrid, Spain (15 Oct 1973).

Automatic three-dimensional dosimetry in electron beams is a method for either reducing any undesired distortion of the isodose curves or for modifying the usual isodose patterns to match any tumor shape. The term "automatic" is used to mean self-regulating or self-acting. The principle of feedback for controlling the operation of an electron accelerator to provide for automatic control of dose within a patient treatment field is discussed. (WHK)

**1094** (JINR-P13-7176) Q METER WITH AUTOMATIC FINE ADJUSTMENT OF THE INPUT CIRCUIT. Drazhev, M. N.; Ivanenko, A. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1973. 11p. (In Russian). Dep. NTIS (U.S. Sales Only) $3.00.

A transistorized Q meter for measurement of the polarization in proton targets is described. By means of the phase-sensitive detector, fine adjustment of the input sequential circuit is effected which makes possible very exact measurements of the polarization magnitude. (tr-auth)

**1095** (SLA-73-837) EFFECTS OF THIN OXIDE FILMS ON NEUTRON PRODUCTION AND ELECTRON EMISSION FROM ERBIUM HYDRIDE TARGETS. Brice, D. K. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1973. Contract AT(29-1)-789. 31p. Dep. NTIS $3.75.

Low-energy experimental data and high-energy theoretical values are used to obtain the parameters Z, a, and n for the Brice stopping power formula for hydrogen ions incident on erbium oxide targets. The resultant stopping power formula allows accurate extrapolation of the stopping power data into energy regions for which no experimental or theoretical data exist. The energy loss of 50- to 300-keV deuterons and tritons in 100 Å and 300 Å erbium oxide films is calculated from the stopping power formula. The reduction in neutron production caused by these energy loss values is calculated for 50- to 300-keV tritons incident on ErD and for 50- to 300-keV deuterons incident on ErT. The results for 300 Å oxide films indicate reduction in neutron production of approximately 1% at 300 keV and 30% at 50 keV for both ion–target combinations. The percentage reductions are decreased by a factor of 3 for the 100 Å films, and are independent of the target loading ratio. Also investigated are the effects of 100 Å, 300 Å, and 900 Å oxide films on the spectrum of electrons emitted from ErT targets. Small reductions in endpoint energy and in electron intensity are predicted for these films. (1 figure, 6 tables) (auth)

**1096** ENERGY MODULATION IN NUCLEAR TARGETS. Consarnau, A. F. Mexico City; Universidad Nacional Autonoma de Mexico (1973). 82p. (In Spanish).

Thesis.

Various studies of nuclear reactions with accelerators require a change in energy of the beam of the accelerator for the purpose of covering a certain range. One method that makes it possible to reduce the time of operation of the accelerator is based on the modulation of the voltage. This technique consists in applying a voltage to the target being studied and deriving a signal proportional to it when an event of interest for the experiment takes place. If this voltage is changed within the range required for the experiment, it is possible to present the results directly in a pulse height analyzer in which the experiment is carried out. The technique of modulation previously used consists of applying a voltage linear in time which implies the use of very elaborate electronic equipment. With the purpose of simplifying this problem, the possibility of using a sinusoidal voltage signal to modulate the energy of the accelerator beam was studied. The tests carried out were accomplished with a tandem Van de Graaff accelerator, model E. N., studying the beam from the $^7Li(p,n)^7Be$ reaction, which makes it possible to analyze the sine wave as voltage modulation. From the results of the above-mentioned reaction there was obtained a second calibration of the accelerator magnet as well as an estimation of the dispersion of the proton beam from the same accelerator; as an example of the utility of the method of modulation there are shown the results of the measurement of the thickness of a thin film of Formvar, which is commonly used as a target support. It was considered necessary to discuss the theory associated with thresholds as a means of justifying the exponent 2/3 from the production of residual particles in the reaction. (tr-auth)

**1097** MICROPROGRAMMED BRANCH DRIVER FOR A PDP-11 COMPUTER. Biswell, L. R. (Los Alamos Scientific Lab., NM). pp 333-340 of Papers and Presentations of Digital Equipment Computer Users Society Spring Symposium. Maynard, MA; Digital Equipment Computer Users Society (1972).

From digital equipment computer users society spring symposium; Boston, Massachusetts, USA (11 May 1972). See CONF-720516−.

A microprogrammed branch driver (MBD) has been developed for the Los Alamos Meson Physics Facility (LAMPF) experimental area data-acquisition systems. The unit is a multiple, direct memory access (DMA) channel branch driver. The work evolved from a cooperative venture between Los Alamos Scientific Laboratory (LASL) and Bonner Research Laboratories, Rice University, to develop a CAMAC branch driver for the PDP-11 computer. As the work progressed the designs took different directions. The basic specifications and operations of the Los Alamos MBD are discussed. (auth)

**1098** ELECTRON BEAM WITH MOMENTA UP TO 46 GeV/c AT THE SERPUKHOV ACCELERATOR. Gershtein, S. S.; Samoilov, A. V.; Sapunov, Yu. M.; Frolov, A. M. At. Energ. (USSR); 35: No. 3, 181-187(Sep 1973). (In Russian).

An electron beam with maximum momentum $p \sim 46$ GeV/c has been produced at the Serpukhov proton synchrotron. The beam intensity varies from $10^6$ electrons at 26 GeV/c to $3 \times 10^4$ electrons at 46 GeV/c for $10^{12}$ protons circulating in the accelerator at 70 GeV; these intensities are for a ± 3% momentum bite and spill lengths of up to 2 sec. Electrons with momenta $p < 26$ GeV/c are produced by decrease of proton energy. Hadron and muon impurity in the beam is less than 1% at momenta $p \sim 26$ to 40 GeV/c and increase to 3.6% at $p = 45.5$ GeV/c. A beam of tagged photons with energies between 12 and 40 GeV has also been produced. (auth)

# PHYSICS (ASTROPHYSICS AND COSMOLOGY)

## Cosmic Radiation

*Refer also to abstracts 1225, 1226, 1232, and 1949.*

**1099** MODULATION OF THE GALACTIC COSMIC RADIATION IN THE SOLAR SYSTEM. Valas, G. (Central Research Inst. for Physics, Budapest). Magy. Fiz. Foly.; 21: No. 3, 220-244(1973). (In Hungarian).

The present state of knowledge concerning the structure of interplanetary space is described on the basis of the most recent experimental data. The galactic cosmic radiation is modulated by the magnetic field and the interplanetary plasma. Knowledge of the modulation will, hopefully, help to evaluate the unmodulated radiation. The present main goal, i.e., study of interplanetary space by means of cosmic radiation, has received considerable impetus during the 1950s as a result of the large body of data obtained during the International Geophysical Year and by satellites and space probes. The modulation has been investigated by means of the Pioneer 10 and 11 satellites, by determining the induced radioactivity of meteorites, and on the basis of periodicity of cosmic radiation. The general structure of the modulated region is indicated with consideration of the magnetic lines of force, the solar wind, and the co-rotational particle stream. The azimuthal, radial, and vertical components of the radiation density gradients are of great interest in this respect. The various types of modulation are presented in tabular form. (Review of the literature, 93 references). (TTT)

**1100** PROPAGATION OF COSMIC RADIATION IN THE SOLAR SYSTEM. Kota, J. (Central Research Inst. for Physics, Budapest). Magy. Fiz. Foly.; 21: No. 3, 191-219(1973). (In Hungarian).

Most of the cosmic radiation that can be observed on the Earth's surface consists of protons and, to a lesser extent, of other particles such as electrons and heavy nuclei coming from the Galaxy. Parker's convection–diffusion theory, based on data obtained with space probes, states that variations in the cosmic radiations reflect solar wind processes in interplanetary space. This theory is described, discussing the structure of interplanetary space, the convection–diffusion equations, the Compton–Getting factor, and the effect of energy changes and presenting approximate solutions for the equations that describe the propagation of the radiation. The effect of anisotropic diffusion is evaluated, examining the electro-static space model within the framework of the study of the energy spectra of galactic radiation. Flare phenomena, which involve the sudden emission of corpuscular radiation in the 1- to 1000-MeV range, are analyzed to derive the time dependence of the anisotropy and the particle emission, with consideration of the Forbush effect. (TTT)

**1101** ORIGIN OF COSMIC RADIATION. Kiraly, P. (Central Research Inst. for Physics, Budapest). Magy. Fiz. Poly.; 21: No. 3, 291-310(1973). (In Hungarian).

Recent studies on the generation and propagation of cosmic radiation are critically reviewed, considering primarily the radiation which consists of $10^8$- to $10^{12}$-eV protons and nuclei and also the very high-energy (greater than $10^{17}$ eV) particles. The latter involve only a minute portion of the total radiation, but their study has contributed greatly to the understanding of the acceleration and propagation mechanisms. The astronomical context of the problem is identified, followed by a listing of the measured characteristics of the primary cosmic radiation. The fundamental physical processes of acceleration and propagation of the radiation are discussed, with a review in greater detail of the most probable models of their origin, which include "galactic" models, the "Colgate" model, pulsar model, and "mixed" models. (Review article, 43 references) (TTT)

**1102** LOW FREQUENCY RADIO EMISSION FROM EXTENSIVE AIR SHOWERS. Gregory, A. G.; Clay, R. W.; Prescott, J. R. (Univ. of Adelaide). Nature (London); 245: No. 5420, 86-87(14 Sep 1973).

It is stated that radio pulses associated with extensive air showers have been observed over a frequency range of 2 to 550 MHz. Measurements over the range 20 to 100 MHz have proved to be the most easily made. At the highest frequencies a decrease in the lateral extent of the radiation, a decrease in its amplitude, and increasing receiver noise have limited observations, and at the lowest frequencies the experimental problem is background noise. Only the use of highly directional antennas, or exploiting the reduction in daytime noise due to ionospheric D-layer absorption, has enabled measurements down to 2 MHz to be made. The lowest frequencies, however, are of particular interest, since the large amplitudes reported appear to be in gross disagreement with theory. Also, long wavelength radiation might prove to have a large lateral spread that could be exploited with a large air shower detecting array. Except in very remote areas frequencies immediately below 2 MHz cannot be employed because of the presence of broadcasting. Below the medium wave broadcast band, however, there is a range of frequencies which (at least in Australia) is still relatively unused. Preliminary work in this region is described, carried out with the Adelaide University air shower array. The equipment and technique employed are described in detail. The shower rate was one per 500s, with primary energies of $10^{15}$ to $10^{16}$ eV. Some 10,000 showers were recorded since March 1973. A positive correlation was observed between pulse amplitude and shower size, and it was concluded that the rms vertical field strength of the observed pulses was ~500 $\mu$v/m/MHz. Published results at 22, 6, and 2 MHz, together with the present results, indicate a spectrum of field strength E against frequency v that can be represented as a power law, $E(v) \sim v^{-1.5}$. Some of the observations were not consistent with any present theory of radio pulse emission and the only mechanism that could conceivably explain the results is that in which the observed signal arises from an interaction between the vertical electric potential gradient existing in the atmosphere and the ionisation due to the air showers. (UK)

**1103** SPATIAL DISTRIBUTION OF ELEMENTS IN TEKTITES AND COMPARABLE MATERIALS BY CHARGED PARTICLE ACTIVATION ANALYSIS. Askouri, N. A.; Durrani, S. A.; Fremlin, J. H. (Univ. of Birmingham, Eng.). J. Geophys. Res.; 78: No. 8, 1245-1252(10 Mar 1973).

The spatial distribution of elements in tektites from Indochina and Czechoslovakia and in certain terrestrial materials has been studied by charged particle activation analysis and $\beta$ autoradiography in an attempt to throw light on the mode of formation of tektites. Tektites from both of these strewn fields, as well as volcanic glass from the island of Melos, show homogeneous distributions within the accuracy of the experiment. On the other hand, impactites from Ries crater in Germany and Lake Bosumtwi in Ghana (and, even more, a granite used for comparative purposes) show considerable inhomogeneity of elemental distribution. The conclusions drawn from these observations are discussed. (auth)

**1104** DEPTH VARIATION OF COSMOGENIC NOBLE GASES IN THE ~120-kg KEYES CHONDRITE. Wright, R. J.; Simms, L. A.; Reynolds, M. A.; Bogard, D. D. (Manned Spacecraft Center, Houston, TX). J. Geophys. Res.; 78: No. 8, 1308-1318(10 Mar 1973).

Cosmic-ray spallation produced $^3$He, $^{21}$Ne, $^{22}$Ne, and $^{38}$Ar were measured as a function of depth in three mutually perpendicular cores (56, 51, and 21 cm) taken from the ~120-kg L chondrite found near Keyes, Oklahoma. The data obtained represent the first experimental determination of the depth variation in the production rates of these cosmogenic nuclides in a single stone meteorite. Fifteen samples across the 56-cm core showed maximum concentration changes of 14% $^3$He, 28% $^{21}$Ne, 19% $^3$He/$^{21}$Ne, and 5% $^{22}$Ne/$^{21}$Ne. The 51-cm core showed somewhat smaller concentration changes. All three cores are characterized by increasing production of $^3$He and $^{21}$Ne concentrations and decreasing $^3$He/$^{21}$Ne and $^{22}$Ne/$^{21}$Ne ratios with depth. A relatively broad maximum in the spallation production of $^3$He and $^{21}$Ne occurs at a depth of >20 cm. The ranges of $^3$He/$^{21}$Ne and $^{22}$Ne/$^{21}$Ne ratios observed in Keyes (5.7 to 4.8 and 1.14 to 1.08, respectively) are typical of the irradiation hardness experienced by many ordinary chondrites and imply shielding of 5 to 35 cm. These ratios are not as depth sensitive as $^{21}$Ne production rates for chondrites but offer a possible means for making relative shielding corrections to calculated noble gas exposure ages. (auth)

**1105** OBSERVATIONS OF THE COSMIC RAY MODULATION FROM NEUTRON MEASUREMENTS AT THE HIGH LATITUDE TRANSITION MAXIMUM. Verschell, H. J. New York; New York Univ. (1972). 157p. University Microfilms Order No. 73-19,979. Thesis (Ph. D.).

Measurements of secondary neutrons were used to examine some features in the modulation of cosmic rays. The non-uniqueness of the regression curves of the 2 to 10-MeV neutron flux vs the neutron monitor counting rates indicated that the rigidity (P) dependence of the long term variation was not independent of time. The change in the P-dependence can generally be associated with the occurrence of various short term phenomena. The rigidity dependence of the modulation was relatively independent of time for extended periods of time between events, particularly following cosmic-ray minimum. The modulation parameter $\beta \ln(J/J_0) = -cP^{-n}$ was obtained. The modulation during short term decreases in the cosmic-ray intensity was found to be less rigidity dependent than for the long term variation. In a Forbush decrease, the rigidity dependence of the modulation was least during the main phase of the event, and the modulation was more rigidity dependent on the initial decline and during the recovery. For decreases more symmetric in temporal profile, the rigidity dependence of the modulation during the decrease and recovery was generally the same. The observed increases in the 2 to 10-MeV neutron flux resulting from protons of solar origin were compared with the values obtained from a Monte Carlo transport calculation. The calculated neutron flux was generally greater than the observed, especially for low energy events. (Diss. Abstr. Int., B)

1106 DIRECT AND INVERSE PROBLEM OF COSMIC-RAY PROPAGATION IN INTERPLANETARY SPACE. Toptygin, I. N. (Leningrad Polytechnic Inst.). Geomagn. Aeron. (USSR) (Engl. Transl); 13: No. 2, 181-186(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 212-218(1973).

The transport of cosmic rays in interplanetary space in the framework of a spherically symmetric model taking into consideration the diffusion of particles and their convection with solar wind and deceleration in a diverging flux of magnetic inhomogeneities is discussed. Green's function of the steady-state transfer equation is plotted and used to obtain the solution of certain direct and inverse problems of cosmic ray propagation. The inverse problem of propagation of galactic cosmic rays is reduced to the solution of the Volterra integral equation of the first kind with one variable, whose kernel is expressed via Green's function for an infinite medium. The direct problem of steady-state diffusive propagation of solar cosmic rays is solved in quadratures for an arbitrary spectrum in the source and an arbitrary dependence of the diffusion coefficient on energy, and the inverse problem is reduced to the solution of an integral equation. (auth)

1107 CONTINUOUS DETERMINATION OF INSTRUMENTAL VARIATIONS WITH A HIGH DEGREE OF ACCURACY FOR DOUBLE-COINCIDENCE MUON TELESCOPES WITH THE AID OF A DISCRIMINATION SURFACE. Libin, I. Ya. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 307-309(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 357-358(1973).

In designing instruments to be used for studying cosmic-ray intensity variations, one of the chief objectives is to ensure the constancy of the instrumental parameters in time or a continuous check of the instrumental errors. Such checking becomes particularly important in the case of the double-coincidence scintillation supertelescope. It is possible to achieve a continuous determination of the instrumental variation (correction for one channel). In determining the sensitivity change of each of the channels of the double-coincidence telescope, an attempt is made to obtain the discrimination characteristics of the telescope as a whole. (MHR)

1108 COSMIC $\bar{p}$ PRODUCTION IN INTERSTELLAR pp COLLISIONS. Gaisser, T.K.; Maurer, R.H. (Bartol Research Foundation of the Franklin Institute, Swarthmore, Pennsylvania, 19081). Phys. Rev. Lett. 30: No. 25, 1264-1267 (18 June 1973).

We place a conservative upper limit of $\approx 4.6 \times 10^{-4}$ on the fraction of antiprotons expected in the cosmic-ray flux at the top of Earth's atmosphere due to collisions of primary cosmic rays with interstellar hydrogen. The implication of this result for experiments designed to detect the existence of antimatter in the universe is discussed. We have parametrized existing data on the $\bar{p}$ inclusive cross section from threshold to intersecting-storage-ring energies to obtain the result. (auth)

1109 A NEW TEST FOR SOLAR MODULATION THEORY: THE 1972 MAY-JULY LOW-ENERGY GALACTIC COSMIC-RAY PROTON AND HELIUM SPECTRA. Garcia-Munoz, M.; Mason, G.M.; Simpson, J.A. (Enrico Fermi Institute, University of Chicago). Astrophys. J. Lett. 182: No. 2, L81-L84 (1 June 1973).

For a three-month period in 1972 we have measured the low-energy galactic cosmic-ray proton and helium spectra using the University of Chicago IMP-5 satellite experiment. Although the proton spectrum has a characteristic rising slope in the interval 30-100 MeV, the helium spectrum shows a previously unobserved feature: an intensity essentially independent of kinetic energy below 80 MeV per nucleon. Indeed, below $\approx 35$ MeV per nucleon, the helium flux exceeds the proton flux. It is pointed out that current models of solar modulation can account for the satellite observations 1965-1969, and the 1969-1971 period which included phase-lag effects during the recovery phase of current solar cycle modulation. However, we cannot extend these techniques with previously successful boundary conditions and diffusion coefficient changes to fit all the features of the 1972 May-July observations below 100 MeV per nucleon. (auth)

1110 OBSERVATIONS OF GAMMA-RAY BURSTS OF COSMIC ORIGIN. Klebesadel, R.W.; Strong, I.B.; Olson, R.A. (University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico). Astrophys. J. Lett. 182: No. 2, L85-L88 (1 June 1973).

Sixteen short bursts of photons in the energy range 0.2-1.5 MeV have been observed between 1969 July and 1972 July using widely separated spacecraft. Burst durations ranged from less than 0.1 s to $\approx 30$ s, and time-integrated flux densities from $\approx 10^{-5}$ ergs cm$^{-2}$ to $\approx 2 \times 10^{-4}$ ergs cm$^{-2}$ in the energy range given. Significant time structure within bursts was observed. Directional information eliminates the Earth and Sun as sources. (auth)

1111 COSMIC RAY ELECTRONS FROM 0.2 TO 8 MEV: PIONEER 8 AND 9 MEASUREMENTS OF THEIR SPECTRUM, TIME VARIATIONS, AND INTERPLANETARY RADIAL GRADIENT. Webber, W.R.; Lezniak, J.A.; Damle, S.V. (Physics Department, University of New Hampshire, Durham, New Hampshire, 03824). J. Geophys. Res. 78: No. 10, 1487-1501 (1 Apr 1973).

Using data from the University of New Hampshire cosmic ray experiment on the Pioneer 8 and 9 space probes at radial distances from 0.75 to 1.10 AU from the sun, we have made a detailed examination of the spectrum, time variations, and interplanetary gradients of cosmic ray electrons from $\approx 0.3$ to 8 Mev. These data cover the time period from December 1967 to April 1969. Obvious solar flare electron increases have been removed from the data, so that the remaining data should represent quiet time electron behavior. We observe a strong and direct correlation between changes in electron intensity over the entire 0.3- to 8-Mev range on Pioneers 8 and 9 and those for 3- to 12-Mev electrons observed simultaneously on the Imp satellites. We find that, when an intensity change occurs, the electron spectrum simply moves bodily up and down, maintaining very nearly the same spectral exponent; in effect, the electron modulation is found to be essentially rigidity independent throughout the 0.3- to 8-Mev range. This behavior appears to be an average property of quiet time electron changes during the time we have studied them and extends as well to the quiet time electron increases that we also observe in direct conjunction with those reported from Imp. The average quiet time day to day changes in electron intensity show very little correlation with day to day changes in higher-energy nuclei, however, except during Forbush decreases when the observed modulation of electrons is found to be directly correlated with, but $\approx 2.5 \times$ larger than the $>60$-Mev nuclei changes. The average electron spectrum we measure is $dJ/dE = 170/E^{1.7}$ particles cm$^2$ ster sec Mev between 0.2 and 8 Mev. The average quiet time interplanetary electron gradient is observed to be $+25 \pm 20\%$/AU from Pioneer 8 data in 1968 and $+3\% \pm 5\%$/AU from Pioneer 9 data in 1969 over the radial range from 0.75 to 1.10 AU. (auth)

1112 SOLAR AND GEOMAGNETIC MODULATION OF LOW-ENERGY SECONDARY COSMIC RAY ELECTRONS. Luhmann, J.G.; Earl, J.A. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland, 20742). J. Geophys. Res. 78: No. 10, 1502-1514 (1 Apr 1973).

Balloon exposures of hodoscope instruments at Churchill, Manitoba, Minneapolis, Minnesota, and Sioux Falls, South Dakota, have established that the flux of return albedo electrons does not depend upon launch latitude and varies with solar modulation in proportion to the intensity of atmospheric secondary electrons. Only one flight out of 21 showed any indication of a magnetospheric electron flux significantly in excess of that attributable to albedo. Diurnal changes in geomagnetic cutoffs exhibit marked variability from day to day, as was illustrated by one flight in which a low cutoff was observed at Churchill throughout the daytime hours. The intensity increase of 15 to 65 Mev primary cosmic ray electrons due to solar modulation was no more than a factor of 2 from 1969-1970 to 1971. (auth)

1113 OBSERVATIONS OF THE AUGUST 1972 COSMIC RAY STORM AT HIGH RIGIDITIES. Swinson, D.B. (Department of Physics and Astronomy, University of New Mexico, Albuquerque, New Mexico, 87106). J. Geophys. Res. 78: No. 10, 1707-1708 (1 Apr 1973).

Observations of the effects of the August 4, 1972, cosmic-ray storm on mid-latitude and polar neutron monitors have been reported by Pomerantz and Duggal (unpublished manuscript, 1972); in their report the details of the variations in the cosmic-ray intensity are related to events on the Sun. In this letter these decreases in intensity are compared with similar observations from three underground mu-meson telescopes, whose threshold rigidities are 17, 30, and 52 Gv. From these observations it is possible to estimate upper limits for the rigidities of cosmic rays that were affected by this storm. (WDM)

1114 THE FLUORINE ABUNDANCE IN THE GALACTIC COSMIC RADIATION. Cartwright, B.G.; Garcia-Munoz, M.; Simpson, J.A. (Enrico Fermi Institute, University of Chicago). Astrophys. J. 182: No. 1, 9-15 (15 May 1973).

The abundance of fluorine relative to oxygen, Γ (F/O), has been measured in the energy ranges 100-200 MeV per nucleon and greater than or equal to 1000 MeV per nucleon on the satellite IMP-5 in 1969–1970 and compared with earlier satellite measurements. The ratio Γ (F/O) has the values 0.030±0.007 and 0.023±0.003 at 150 and greater than or equal to 1000 MeV per nucleon, respectively. Production of fluorine by spallation in the interstellar medium has been calculated with account taken of all elements with nuclear charge number $8 \leq Z \leq 16$, and iron—including secondary, tertiary, and higher-order production—for several models of galactic cosmic-ray propagation. The observed abundance ratio can be accounted for by propagation. The upper limits for fluorine in cosmic-ray sources is less than or equal to 0.01, and may be zero. (auth)

**1115** PRODUCTION OF ASTROPHYSICAL X-RAYS BY TRANSITION RADIATION. Watson, W.D. (Center for Radiophysics and Space Research and Laboratory for Atomic and Solid State Physics, Cornell University). Astrophys. J. 182: No. 1, 17-24 (15 May 1973).

Results of detailed calculations are presented for the spectrum of transition radiation produced when relativistic charged particles traverse astrophysical dust grains. The "formation zone" for X-ray generation is greater than dimensions of typical astrophysical grains so that the efficiency of the process is appreciably reduced. When competing processes and upper limits to the galactic electron flux are considered, neither the low-energy (≈1/4 keV) nor the higher-energy (≈1–20 keV) X-rays associated with the galactic disk can be explained by transition radiation from grains. This conclusion is contrary to that of some other investigators. Transition radiation is comparable with other radiation processes in some models for the nuclei of active galaxies. (auth)

## Stars

*Refer also to abstracts 1248, 1734, and 1815.*

**1116** PROBLEMS WITH STRONG-LINE G AND K DWARFS. Alexander, J. B.; Branch, D. Mon. Notic. Roy. Astron. Soc.; 164: No. 1, 19P-25P(1973).

The ($M_v$, R-I) diagram is obtained for a sample of G and K stars having well-determined trigonometric parallaxes. Although most stars form a well-defined main sequence, strong-line stars show an unexpectedly large scatter. The importance of understanding this phenomenon and the spectroscopic characteristics of the strong-line stars is stressed. (auth)

**1117** CARBON STARS IN THE SMC GLOBULAR CLUSTERS NGC 121, NGC 419, AND KRON 3. Feast, M. W.; Evans, T. L. (Radcliff Observatory, Pretoria). Mon. Notic. Roy. Astron. Soc.; 164: No. 1, 15P-18P(1973).

Spectroscopic observations of stars with (B−V) near 2.0 or greater in NGC 121, NGC 419, and Kron 3 have revealed carbon stars in each cluster. Statistics of very red stars show that they are unlikely to be field stars. These carbon stars have $M_v$ = −3.0. Some observations of the galactic globular cluster NGC 362 are also reported. (auth)

**1118** CARBON STAR IN NGC 2477. Catchpole, R. M.; Feast, M. W. (Radcliff Observatory, Pretoria). Mon. Notic. Roy. Astron. Soc.; 164: No. 1, 11P-13P(1973).

A carbon star has been found to be a radial velocity member of the intermediate age cluster NGC 2477. Very red carbon stars appear to be frequent in such clusters but not in galactic globular clusters. This suggests the possibility that the Magellanic Cloud globular clusters with very red (carbon) stars are somewhat younger than typical galactic globular clusters. (auth)

**1119** NITROGEN ENRICHMENT DUE TO MERIDIONAL CIRCULATION IN MAIN SEQUENCE STARS. Demarque, P.; McClure, R. D. (Yale Univ., New Haven). Mon. Notic. Roy. Astron. Soc.; 164: No. 1, 5P-9P(1973).

Paczyński (Acta Astr.; in press (1973)) has presented arguments in support of the idea that rotating main-sequence stars in the mass range 2 to 10 $M_\odot$ should show evidence for carbon depletion and nitrogen enrichment in their envelopes. An attempt to test this theory in terms of the relative CN-strength of K-giant stars tends to support Paczyński's suggestion. (auth)

**1120** STRUCTURE OF ROTATING STARS. The $J^2$ Method and Results for Uniform Rotation. Papaloizou, J. C. B.; Whelan, J. A. J. (Univ. of Sussex, Brighton, Eng.). Mon. Notic. Roy. Astron. Soc.; 164: No. 1, 1-10(1973).

The $J^2$ method for solving the structure of uniformly and nonuniformly rotating stars is briefly described and compared with other methods. The method is restricted to rotation laws of the form $\Omega = \Omega(\omega)$, but involves no approximation regimes and is capable of creating a self-consistent density and potential field. The structure equations are written in essentially the same form as they would take in the absence of rotation. The explicit effects of rotation are included through correction factors which depend only on the total potential. Results are given for uniform rotation using a Roche approximation in order to calculate the correction factors. Corrections arising from a better approximation to the potential are shown to be small. The results show good agreement with other authors but some discrepancies are pointed out. (auth)

**1121** WOLF 424. A Neglected Flare Star. Moffett, T. J. (Univ. of Texas, Austin). Mon. Notic. Roy. Astron. Soc.; 164: No. 1, 11-20(1973).

Four-color high-speed photometric observations of the UV Ceti type flare star Wolf 424AB are presented. This system may be one of the most active flare stars known. During a period of 2.62 hr 12 flares were detected and flare activity accounted for approximately 8% of the total energy received from the system in the U-bandpass. The observations of the largest flare are compared with the predictions of the fast-electron flare model proposed by Gurzadyan (Astrofiz.; 4: 154(1968)) which is remarkably successful though some discrepancies exist. The basic hypothesis of the fast-electron model is questioned. (auth)

**1122** STARS IN RADIATIVE EQUILIBRIUM CONTAINING MULTIPOLE MAGNETIC FIELDS. Moss, D. L. (Univ. of Manchester, Eng.). Mon. Notic. Roy. Astron. Soc.; 164: No. 1, 33-51(1973).

Models of uniformly rotating stars in purely radiative equilibrium containing multipole magnetic fields are constructed by a perturbation technique. Initially calculations are performed for a mixture of $P_2$ and $P_4$ fields. It is found that for a given surface $P_2$ field both the $P_2$ and $P_4$ components of magnetic field have to be very strongly concentrated in the interior as the rotation speed increases. For a given interior magnetic flux there is found to be a maximum rotation speed at which it is possible to find solutions. However, unlike the analogous problem with a dipole-type magnetic field, this does not correspond to the limit of zero surface field. The calculations are extended to include a $P_6$ component of field, and some evidence for the convergence of the expansion procedure for the field is found. (auth)

**1123** REFLECTION MODEL FOR ECLIPSING BINARY STARS. Wood, D. B. (Goddard Space Flight Center, Greenbelt, MD). Mon. Notic. Roy. Astron. Soc.; 164: No. 1, 53-64(1973).

A highly accurate reflection model has been developed which emphasizes efficiency of computer calculation. It is assumed that the heating of the irradiated star must depend upon the following properties of the irradiating star: (1) effective temperature; (2) apparent area as seen from a point on the surface of the irradiated star; (3) limb darkening; and (4) zenith distance of the apparent centre as seen from a point on the surface of the irradiated star. The algorithm eliminates the need to integrate over the irradiating star while providing a highly accurate representation of the integrated bolometric flux, even for gravitationally distorted stars. (auth)

**1124** HORIZONTAL BRANCH AND THE COSMIC ABUNDANCE OF HELIUM. Gross, P. G. (Yale Univ., New Haven). Mon. Notic. Roy. Astron. Soc.; 164: No. 1, 65-92(1973).

Stellar models deriving their luminosities from helium burning in the core and hydrogen burning in a shell are investigated for helium core masses of 0.425, 0.450, and 0.475 $M_\odot$, and for total masses ranging from 1.35 $M_\odot$ down to the respective core masses. The investigated helium and heavy-element abundances lie within the ranges (0.25, 0.45) and (0.0001, 0.06) respectively. The readjustment of the hydrogen burning shell on the horizontal branch is studied. The effect of a changing core mass as a function of the width of this hydrogen profile is used to extend the validity of previous zero-age-horizontal-branch computations with steep profiles into the regime of broadened, typical horizontal-branch profiles. The color dispersion of stars along the horizontal branch is found to be about twice as sensitive to a core-mass spread than to an equal spread in total mass. Preliminary evidence for the existence of a core-mass spread along the blue horizontal branches of globular clusters is presented. A new method for determining the helium abundances of horizontal-branch stars is presented. The method is shown to be independent of the heavy-element abundance, of the mixing length, of small changes in the hydrogen composition profile, and independent of the main effects of evolution during the core-helium burning phase. Comparisons with available observations indicate that the helium abundance of the halo population of the Galaxy is greater than 0.30 ± 0.04 by mass fraction. The helium abundances of seven open clusters average to 0.23, with an uncertainty of 0.10 to 0.20. This inverse correlation between the helium abundance and angular momentum of the populations in our Galaxy is supported by a preliminary study of helium abundances obtained from other methods. The cosmological implications of this "inverse" helium composition gradient suggest that either some helium enriching mechanism acted during the protogalactic collapse in regions of high density and low metal abundance or (and) the chemical inhomogeneities were created in the primeval fireball. (auth)

1125 NON-SPHERICAL STRUCTURE OF THE NOVA NEBULOSITY. Sparks, W. M. (Goddard Space Flight Center, Greenbelt, MD); Starrfield, S. Mon. Notic. Roy. Astron. Soc.; 164: No. 1, 1P-4P(1973).

The observed nonspherical structure of the material ejected during the nova outburst is caused by material expanding off the surface of the white dwarf and colliding with the ring of material that surrounds the white dwarf. The forbidden emission line ratios suggest a higher equatorial density which supports this hypothesis. (auth)

1126 SPECTROSCOPIC SURVEY OF SOUTHERN HEMISPHERE WHITE DWARFS. II. Spectroscopic Data for Forty-One Southern White Dwarfs. Wegner, G. (Oxford Univ.). Mon. Notic. Roy. Astron. Soc.; 163: No. 4, 381-390(1973).

New spectroscopic data on 41 southern white dwarfs are presented. Most of these stars have not been previously observed spectroscopically. Spectral types, as well as equivalent widths and line profiles for a few selected lines, are given. (auth)

1127 W URSAE MAJORIS. The Parameters of a Contact Binary. Worden, S. P.; Whelan, J. (Univ. of Arizona, Tucson). Mon. Notic. Roy. Astron. Soc.; 163: No. 4, 391-400(1973).

Spectroscopic radial velocity observations of W Ursae Majoris, the prototype contact binary, are reported. The parameters (masses, radii, luminosities) of the system have been determined. There is a real discrepancy between the spectroscopically determined mass-ratio of W Ursae Majoris and the photometrically determined one. BD + 55° 1351 and W Ursae Majoris share the same space motion which provides an estimate of the distance to the system. A theoretical main-sequence contact binary model is constructed which reproduces the observations. (auth)

1128 OBLIQUE ROTATOR MODEL OF MAGNETIC STARS. Monaghan, J. J. (Monash Univ., Clayton, Australia). Mon. Notic. Roy. Astron. Soc.; 163: No. 4, 423-435(1973).

A model of an oblique rotator has been constructed for an upper main sequence star assuming that the rotation is uniform and that the magnetic field is not axisymmetric with respect to the rotation axis. Interpreting the field in terms of an inclined magnetic dipole, it is found that as the angle between the rotation and dipole axes increases, the ratio central field/surface field decreases. Thus magnetic stars with a large angle between the rotation and dipole axes tend to have the larger surface fields. The computations fail to converge when the ratio of rotational to magnetic energy becomes large, but lies below the value relevant to most magnetic stars. This suggests that the results must be extrapolated with caution until more extensive computations are performed. (auth)

1129 29-SECOND OSCILLATIONS IN CD-42° 14462. Warner, B. (Cape Town Univ., South Africa). Mon. Notic. Roy. Astron. Soc.; 163: No. 4, 25P-27P(1973).

Previous investigations have shown that CD-42° 14462 possesses a spectrum suggestive of DA white dwarfs, and that there are in addition broad weak emissions near the centres of Hα and Hβ. Such a spectrum is typical of some cataclysmic variable stars and indicates that CD-42° 14462 should be classified as a nova-like variable. Photometry of CD-42° 14462 was carried out at the Cassegrain focus of the 40-in. reflector at the Sutherland site of the South African Astronomical Observatory. The power spectrum of this run shows a prominent spike at 29s. Apart from this, the power spectrum shows that CD-42° 14462 is relatively quiescent. A periodogram of the light curve is very slightly asymmetric, but this is of only marginal significance. The peak in the periodogram corresponds to a period of 29.04s. (UK)

1130 MOLECULES AND THE 1720 A FEATURE IN HOT SUPERGIANTS. Tarafdar, S. P.; Vardya, M. S. (Tata Inst. of Fundamental Research, Bombay). Mon. Notic. Roy. Astron. Soc.; 163: No. 4, 35P-38P(1973).

A suggestion is made that the recently observed broad absorption feature around 1720 Å in six early-type supergiants and a shell star by Underhill, Leckrone, and West (Astrophys. J.; 171: 63(1972)) may be molecular in origin. This feature remains essentially constant in wavelength, width, and strength over the spectral range Bo I to A2 I and appears to be either absent or very weak in the main-sequence B stars. (UK)

1131 PHYSICS OF STELLAR INTERIORS. Swihart, T. L. Tucson, AZ; Pachart Publishing House (1972). 125p. $7.95.

Aspects of the radiation theory are considered, giving attention to basic quantities, blackbody radiation, the transfer equation, absorption and emission, and radiative relations in stellar interiors. Questions regarding a gas in thermodynamic equilibrium are also examined, taking into account a Maxwell–Boltzmann gas, classical deviations from the M–B distribution, degeneracy, ionization conditions, specific heats, and adiabatic and polytropic changes. Other subjects explored include polytropes, stellar energies, and the structure and evolution of the stars. (IAA)

1132 ABUNDANCE OF LITHIUM IN GALACTIC CLUSTER STARS. Zappala, R. R. Santa Cruz, CA; Univ. of California (1971). 47p. University Microfilms Order No. 73-10,319. Thesis (Ph. D.).

Image intensifier instrumentation was used at the coudé focus of the Lick 120-inch reflector to obtain spectrograms of F to K main sequence stars in the Hyades, Pleiades, and Praesepe clusters, as well as stars still contracting toward the main sequence in NGC 2264. The abundance of lithium was calculated from the measured equivalent widths of Li I λ6707, a grid of model atmospheres, and an empirical correction for saturation effects. Li is present in NGC 2264 in about the same amount as in F and early-G cluster main sequence stars. No Li abundances are observed to exceed the present interstellar upper limit. Because of possible differences in cluster initial Li content, it is difficult to separate the effects of depletion during pre-main sequence evolution from later slow destruction on the main sequence. However, the Pleiades G and K stars appear to be genuinely overabundant in Li with respect to the Hyades and imply a main sequence depletion time scale of $1.5 \times 10^9$ years for solar-type stars, decreasing to about half this value for KO V stars. If Pleiades abundances represent zero-age main sequence values, a shift of about +0.12 in B-V is necessary to bring Bodenheimer's theoretical pre-main sequence depletion versus color relation into agreement with the observations. (Diss. Abstr. Int., B)

1133 ORELA NEUTRON CAPTURE AND STELLAR NUCLEOSYNTHESIS. Allen, B. J. (Australian Atomic Energy Commission, Lucas Heights); Macklin, R. L. At. Energy Aust.; 16: No. 2, 14-21(Apr 1973).

The article reviews briefly the ORELA research program and considers in detail the measurement of fast neutron capture cross sections and the application of these data to reactor physics and stellar nucleosynthesis. (AT)

1134 THERMAL PULSES IN HELIUM SHELL-BURNING STARS. II. Wood, P.R.; Faulkner, D.J. (Mount Stromlo and Siding Spring Observatory, Research School of Physical Sciences, The Australian National University). Astrophys. J. 181: No. 1, 147-156 (1 Apr 1973).

The shell–burning evolution of pure–helium stars in the mass range 0.5–1.0 $M_{\odot}$ is studied, both including and neglecting neutrino energy losses due to the universal Fermi interaction. With neutrino energy losses included, stars of mass 0.5–0.8 $M_{\odot}$ undergo a single thermal pulse before becoming white dwarfs, while more massive stars have stable helium–burning shells. In the absence of neutrino energy losses, carbon burning occurs in the core for $M > 0.8\ M_{\odot}$ . No thermal instability in the helium shell precedes the onset of carbon burning. At 0.7 $M_{\odot}$ carbon fails to ignite and a thermal pulse occurs in the helium shell, while at 0.5 $M_{\odot}$ neither carbon burning nor thermal instability is found. The significance of these results for the central stars of planetary nebulae is discussed, and a possible explanation is given for carbon features in the spectra of the nuclei of advanced planetary nebulae, and of some white dwarfs. A possible relationship with the hydrogen–deficient carbon stars is also discussed. (auth)

1135 ULTRAVIOLET STARS AND THE INTERSTELLAR GAS. Rose, W.K.; Wentzel, D.G. (Astronomy Program and Center for Theoretical Physics, University of Maryland). Astrophys. J. 181: No. 1, 115-123 (1 Apr 1973).

If luminous red giants evolve to white dwarfs via a very hot stage (ultraviolet star), then these stars may have a significant influence on the interstellar medium. We extend the analysis of Hills by considering the evolution of ultraviolet stars and how these stars affect the dynamics of the resulting H II regions. Compared to O stars, the ultraviolet stars are more uniformly distributed and in regions of lower density so that the initial Strömgren spheres are larger. H II regions due to ultraviolet stars are very short–lived and hence unimportant in regions with hydrogen density $n_0 \gtrsim 1\mathrm{cm}^{-3}$; but if most ultraviolet stars occur in a rather uniform intercloud medium with $n_0 \simeq 0.1\ \mathrm{cm}^{-3}$, then their H II regions fill about one-third of this space, produce a mean electron density about 0.03 $\mathrm{cm}^{-3}$, comparable to that indicated by pulsar dispersions, and cause acceleration of interstellar gas adequate to explain the observed interstellar motions. (auth)

1136 RAPIDLY ROTATING NEUTRON STARS. Wilson, J.R. (Lawrence Livermore Laboratory, University of California, Livermore, California, 94550). Phys. Rev. Lett. 30: No. 21, 1082-1084 (21 May 1973).

Models of differentially rotating neutron stars have been calculated.

An upper limit to the rotational enhancement of the maximum gravitational mass is found to be about 50% when the Ostriker–Tassoul instability criterion is used. (auth)

**1137 MODELS FOR CARBON-RICH STARS WITH HELIUM ENVELOPES.** Joss, P.C. (Center for Radiophysics and Space Research, Cornell University); Katz, J.I.; Malone, R.C.; Salpeter, E.E. Astrophys. J. 181: No. 2, 409-428 (15 Apr 1973).

Stellar models with carbon-rich interiors and helium envelopes of varying fractional mass have been constructed. The models have masses of 0.75, 1.02, and 1.37 $M_\odot$. A few 1.02 $M_\odot$ models with hydrogen-rich outer envelopes of small fractional mass have also been constructed. The evolution of these models is compared with the observed evolution of the nuclei of planetary nebulae (NPNs). Some models give good agreement with the luminosities and evolutionary time scales of NPNs, but the effective temperatures of these models are too high. We investigate the minimum mass required for carbon ignition in the stellar interior as a function of the fractional mass of the helium envelope. (auth)

**1138 ON THE "CRITICAL LUMINOSITY" IN STELLAR INTERIORS AND STELLAR SURFACE BOUNDARY CONDITIONS.** Joss, P.C. (Institute for Advanced Study); Salpeter, E.E.; Ostriker, J.P. Astrophys. J. 181: No. 2, 429-438 (15 Apr 1973).

General relations are derived among the so-called critical luminosity $L_{crit}$, and the actual radiative and convective luminosities, $L_{rad}$ and $L_{conv}$, within a star in hydrostatic and local thermodynamic equilibrium. Convection sets in before $L_{rad}$ reaches $L_{crit}$, and the total luminosity can exceed $L_{crit}$ at points well below the surface without mass–outflow being a necessary consequence. A density inversion develops at a value of $L_{rad}$ which is less than $L_{crit}$, and a gas–pressure inversion appears whenever $L_{rad}$ exceeds $L_{crit}$; however, if convection is efficient, neither type of inversion will occur. A general boundary condition for an outer layer of small fractional mass is derived which expresses the surface luminosity in terms of temperature, density, and opacity at the base of the layer and a parameter $\alpha$. This parameter is of order unity as long as the boundary layer is stable against convection; in some cases, it is possible to make an a priori determination of convective stability. Explicit expressions are obtained for a perfect gas plus blackbody radiation and Kramers opacity plus electron scattering. (auth)

**1139 MODELS FOR INITIALLY HOMOGENOUS CARBON–RICH STARS.** Boozer, A.H. (Center for Radiophysics and Space Research, Cornell University, Ithaca, New York, 14850); Joss, P.C.; Salpeter, E.E. Astrophys. J. 181: No. 2, 393-407 (15 Apr 1973).

Stellar models between 0.75 and 1.45 $M_\odot$, initially consisting of 50 percent $^{12}C$ and 50 percent $^{16}O$ (by mass), have been constructed. The evolutionary computations included the most recent nuclear reaction rates and neutrino loss rates (excluding bremsstrahlung neutrinos), screening corrections to the reaction rates, and Coulomb corrections to the thermodynamic properties of the nuclei. The minimum mass for significant carbon–burning is near 1.03 $M_\odot$. Models with masses between $\approx 1.03\ M_\odot$ and $\approx 1.15\ M_\odot$ initially ignite carbon in an intermediate convective shell, while more massive models initially ignite carbon in a convective core. In models with masses greater than $\approx 1.39\ M_\odot$, oxygen shell–burning begins prior to the onset of inverse $\beta$–decays at the stellar center. (auth)

**1140 LINE EFFECTS ON THE RADIATIVE ACCELERATION IN SUPERGIANT STARS.** Böhm–Vitense, E. (Department of Astronomy, University of Washington, Seattle). Astrophys. J. 181: No. 2, 379-385 (15 Apr 1973).

The radiative accleration $g_r$ is studied for supergiants with $T_{eff} \leq 8000°$ K. Nongray effects, including line absorption, raise $g_r$ by a factor of at least 6—in comparison with the gray case—at the surface of the stars. The luminosity limit for stable stars set by $g_r$ will probably be lowered by this factor in comparison with earlier estimates based on electron scattering only. No instability is found for red supergiants. (auth)

**1141 RADIATIVE OPACITY IN STELLAR ATMOSPHERES. IV. REMARKS ON THE ACCURACY OF METAL ABSORPTION COEFFICIENTS.** Matsushima, S.; Travis, L.D. (Department of Astronomy, Pennsylvania State University, University Park). Astrophys. J. 181: No. 2, 387-391 (15 Apr 1973).

The random errors intrinsic to the determination of metal absorption coefficients based on the quantum–defect theory are estimated by comparing independently calculated values. The errors averaged over the entire spectral region appear to be about 30 percent or less for sodium, aluminum, and magnesium, but increase to a factor of 2 for carbon, nitrogen, oxygen, and silicon, suggesting a possibly large error resulting from their use in model–atmosphere calculations for hydrogen–deficient stars. However, for stars of normal abundances such errors seem to remain within 20 percent for the spectroscopically important wavelengths between 1250 and 3500 Å. (auth)

**1142 SCREENING FACTORS FOR NUCLEAR REACTIONS. I. GENERAL THEORY.** DeWitt, H.E.; Graboske, H.C. (Lawrence Livermore Laboratory, University of California); Cooper, M.S. Astrophys. J. 181: No. 2, 439-456 (15 Apr 1973).

A generalized statistical–mechanical theory is developed to describe the effect of plasma screening on nuclear reactions. The screening function [$H_{12}(0) \equiv \ln f$, where f is the screening factor] is generally describable in terms of pair distribution functions of the plasma electrons and ions, and is demonstrated to be a thermodynamic quantity, a function of the chemical potentials of the reacting charges. This theory recovers the previous weak– and strong–screening results of Salpeter, in the appropriate charge and screening strength limits for which they are valid. A new theoretical study of strong screening is next made for the case of equal–charge reactions, based on Monte Carlo calculations of the pair distribution function of the Coulomb fluid. This result, which has wide astrophysical applications, is combined with the theory of Salpeter to construct a generalized screening function for arbitary charge conditions. The generalized screening factor is extended to describe intermediate-screening effects. (auth)

**1143 SCREENING FACTORS FOR NUCLEAR REACTIONS. II. INTERMEDIATE SCREENING AND ASTROPHYSICAL APPLICATIONS.** Graboske, H.C.; DeWitt, H.E. (Lawrence Livermore Laboratory, University of California); Grossman, A.S.; Cooper, M.S. Astrophys. J. 181: No. 2, 457-474 (15 Apr 1973).

The theory of intermediate screening is developed from the cluster expansion for the screening function. This systematic perturabation technique is used to extend weak–screening theory analytically to higher order in the screening parameter, and is solved numerically to yield screening–function data for intermediate and strong screening regions. For both the one–component system, equal charge reactions, and the two–component system in the form of 10 mixtures of low–Z elements, the resultant intermediate–screening function is shown to obey a simple power–law dependence on the screening parameter, $H_{12}(0) \times f(z_i)\ \Lambda_{12}^{b}$, where $b=0.860$. This result is found to be equivalent to the general screening function presented in Paper I. The new screening theory is studied in relation to various astrophysical situations. Three areas are found where screening effects may produce quantitative changes in evolutionary star models: minimum mass limits for H, D, He, C, and O main sequences; the structure and extent of flash events in red–giant interiors; and the strength of detonations in degenerate carbon and oxygen cores. This latter case may require screening–factor increases of two orders of magnitude. (auth)

**1144 SOME TESTS AND CONSEQUENCES OF THE IDENTIFICATION OF PROMETHIUM IN HR 465.** Mitalas, R.; Marlborough, J.M. (Department of Astronomy, University of Western Ontario, London, Ontario). Astrophys. J. 181: No. 2, 475-480 (15 Apr 1973).

We discuss several ways to confirm the identification of Pm in HR 465. Some of these tests are only of academic interest at the present time. However, the emission of X–rays and $\gamma$–rays resulting from the decay of unstable isotopes of Pm and other rare earths makes it worthwhile to attempt to detect HR 465 as an X–ray or $\gamma$–ray source. (auth)

**1145 ON THE STABILITY OF AXISYMMETRIC SYSTEMS TO AXISYMMETRIC PERTURBATIONS IN GENERAL RELATIVITY. IV. ALLOWANCE FOR GRAVITATIONAL RADIATION IN AN ODD–PARITY MODE.** Chandrasekhar, S.; Friedman, J.L. (University of Chicago). Astrophys. J. 181: No. 2, 481-495 (15 Apr 1973).

In the present paper, the variational principle derived in Paper II is clarified; and it is shown how it may be used to treat the damping of the axisymmetric oscillations of a uniformly rotating star, by the emission of gravitational radiation in an odd–parity mode. It is further shown that the expression, for the imaginary part of the frequency as a surface integral (at infinity), which follows from the variational principle, is consistent with the requirements of the conservation of energy. (auth)

**1146 THE EFFECT OF GRAVITATIONAL RADIATION ON THE SECULAR STABILITY OF UNIFORMLY ROTATING FLUID MASSES.** Miller, B.D. (University of Chicago). Astrophys. J. 181: No. 2, 497-512 (15 Apr 1973).

The secular effect of gravitational radiation–reaction on the oscillations of uniformly rotating polytropes and the Maclaurin spheroids is examined. There are examples of oscillations which become unstable, which are damped, and which are unaffected. (auth)

**1147 ON THE EVOLUTION OF THE SECULARLY UNSTABLE, VISCOUS MACLAURIN SPHEROIDS.** Press, W.H.; Teukolsky, S.A. (California Institute of Technology). Astrophys. J. 181: No. 2, 513-517 (15 Apr 1973).

Previous investigations, which are superficially contradictory, are here reconciled. With new numerical results, a consistent picture emerges: A secularly unstable, viscous Maclaurin spheroid slowly and monotonically deforms itself into a stable, Jacobi ellipsoid. The intermediate configurations are Riemann S–type ellipsoids. A misnomer from previous methods terms this monotonic evolution "anti-damped oscillation"; in actuality no physical fluid oscillation is involved. The evolutionary path is almost certainly independent of the details of the viscous force when the viscous force is sufficiently small. (auth)

1148 THE OSCILLATIONS AND THE STABILITY OF ROTATING MASSES WITH MAGNETIC FIELDS. III. Kochhar, R.K.; Trehan, S.K. (Department of Mathematics, Panjab University, Chandigarh, India). Astrophys. J. 181: No. 2, 519-521 (15 Apr 1973).

It is shown that when a magnetic field is present along the axis of rotation, the point of bifurcation, where the Jacobi ellipsoids branch off from the Maclaurin spheroids, occurs at a value of eccentricity which is higher than the value ($e=0.81267$) that obtains in the absence of a magnetic field. This is in contrast to the effect of a toroidal magnetic field which, as has been shown earlier, leaves the point of bifurcation unaffected. (auth)

1149 A NEW APPROACH TO PERIODOGRAM ANALYSES. Gray, D.F.; Desikachary, K. (Department of Astronomy, University of Western Ontario). Astrophys. J. 181: No. 2, 523-530 (15 Apr 1973).

We present a method for Fourier analyzing quasi-periodic light and radial velocity variations. The scheme gives a particularly clear interpretation to the periodogram, reduces the alias problem, allows detection of very weak components, has potential for greater precision in frequency measurement, and is a shorter computation than the usual method. Our developement points out the possibility of error in evaluating the zero-frequency component by the usual method. We derive, under appropriate assumptions, a rigorous evaluation of the phase of each component. (auth)

1150 HIGH-SPEED PHOTOMETRY OF AH HERCULIS. Robinson, E.L. (Department of Astronomy, University of Texas at Austin). Astrophys. J. 181: No. 2, 531-536 (15 Apr 1973).

High-speed photometry of the dwarf nova AH Her is presented. The observations were made during minimum light and at several points on the rising branch of eruptions. Power spectrum analysis revealed no periodicities in any of the light curves, showing that in AH Her, as in CN Ori and Z Cam, the white-dwarf pulsations exist only at maximum light. The lack of visible pulsations on the rising branch puts doubt on those theories of the dwarf nova eruption which require such pulsation. The red spectrum of AH Her is also described. (auth)

1151 A C IV EMISSION FEATURE IN THE NEAR-ULTRAVIOLET SPECTRUM OF THE WOLF-RAYET STAR $\gamma^2$ VELORUM. van der Hucht, K.A.; Lamers, H.J. (Astronomical Institute, Utrecht, The Netherlands). Astrophys. J. 181: No. 2, 537-542 (15 Apr 1973).

Spectrophotometric satellite observations in the ultraviolet of the binary $\gamma^2$ Vel are presented. Spectral features are tentatively identified. An explanation for the strength of the dominating C IV $\lambda$2529.97 emission line is suggested. The diffuse red wing of this line suggests mass transfer from the Wolf-Rayet star to the O-type component. (auth)

1152 FISSION IN STELLAR PLASMA. Duorah, K.; Duorah, H.L. (Department of Physics, Gauhati University, Gauhati 781014, India). Phys. Rev. C 8: No. 2, 725-728 (Aug 1973).

The fission of heavy nuclides is examined in a dense stellar plasma. The correction in the Coulomb energy due to the interaction between the ion and the induced-electron charge density affects the process of fission and reduces the fission barrier depending upon the physical situation. Shell- and surface-symmetry effects are included in the calculation of the fission barrier as a function of the fissility parameter $\chi$ and surface energy of a special nuclear drop $E_s^0$. The fissionability of some of the heavy elements that are likely precursors of superheavy elements in an r-process chain may adversely affect the formation of superheavy elements in stellar situations. (auth)

1153 HD 77581 AS THE OPTICAL COUNTERPART OF 2U 0900-40. Vidal, N.V.; Wickramasinghe, D.T.; Peterson, B.A. (Mount Stromlo and Siding Spring Observatory, Research School of Physical Sciences, Australian National University). Astrophys. J. Lett. 182: No. 2, L77-L79 (1 June 1973).

1154 REDISTRIBUTION OF RESONANCE RADIATION. II. THE EFFECT OF MAGNETIC FIELDS. Omont, A.; Smith, E.W.; Cooper, J. (Joint Institute for Laboratory Astrophysics, University of Colorado, Boulder). Astrophys. J. 182: No. 1, 283-300 (15 May 1973).

Previously obtained results for scattering of radiation in the presence of collisions are restated in a density matrix formalism which employs an irreducible-tensor description of the radiation field. This formalism is particularly useful for problems associated with radiative transfer theory. The redistribution is then extended to include the effect of a weak magnetic field. By averaging over a finite bandwidth which is on the order of the Doppler width, simplified expressions of physical significance for the scattering in the Doppler core and the Lorentz wings are obtained. Expressions are also obtained for the corresponding source function of radiative transfer theory. (auth)

1155 THE WAVELENGTH DEPENDENCE OF LINEAR AND CIRCULAR POLARIZED RADIATION FROM THE MAGNETIC WHITE DWARF GRW+70°8247. Roussel, K.M.; O'Connell, R.F. (Department of Physics and Astronomy, Louisiana State University, Baton Rouge). Astrophys. J. 182: No. 1, 277-282 (15 May 1973).

The wavelength dependence of linear polarization from the magnetic white dwarf Grw+70°8247 is investigated. The gray-body magnetoemissive linear polarization is corrected for radiative transfer by the use of a model white-dwarf atmosphere. The wavelength dependence found by this method does not fit the wavelength dependence of the observed linear polarization. Also the wavelength dependence of the circular polarization from Grw+70°8247 is reexamined in the light of new observations. (auth)

1156 THE ROLE OF CONVECTION IN STELLAR ATMOSPHERES. II. COOL MAIN-SEQUENCE STARS AND METAL-DEFICIENT SUBDWARFS. Travis, L.D.; Matsushima, S. (Department of Astronomy, Pennsylvania State University, University Park). Astrophys. J. 182: No. 1, 189-207 (15 May 1973).

On ths basis of Spiegel's improved theory of convection, a grid of the model atmospheres has been constructed for effective temperatures between 6000° and 4500° K with changing metal content and other atmospheric parameters. Significant effects of the nonlocal flux from a deeper convective zone are seen to change the atmospheric structure in such a way that it reduces the temperature gradient and the gas pressure near the surface, as compared to those resulting from the pure radiative or the traditional treatment of the mixing-length theory. The result of these changes is a reddening of the UBV colors, which is more enhanced as the metal content decreases up to about 1/100 of the solar value. The line-free colors predicted by the models appear to define the upper envelope of observed colors of extreme subdwarfs in the (U—B, B—V)-. or (U—B, R—I)- diagram, indicating the extreme limit of the ultraviolet excess. The effective-temperature scales determined for G and K stars from these models are found to be several hundred degrees higher than some of the earlier estimates. The results appear to offer limited support to the recent view that many, if not all, of the extreme subdwarfs have luminosities definitely lower than the main-sequence stars. (auth)

1157 MICROTURBULENCE IN A STARS AS DERIVED FROM LINE PROFILES. Smith, M.A. (Lick Observatory, Board of Studies in Astronomy and Astrophysics, University of California, Santa Cruz). Astrophys. J. 182: No. 1, 159-175 (15 May 1973).

This study represents an attempt to fix a scale of the "microturbulent velocity" in main-sequence A stars by examining the profiles of weak and saturated lines of six sharp-lined Am stars. Although the study is photographic, so that it is difficult to determine accurate core and wing parameters, studies of the loci of half-intensity widths and core shapes provide useful information. If a total broadening due to rotation and microturbulence is chosen on the basis of agreement between observed and computed intermediate-strength lines, it is found that the strongest lines are narrower and deeper than predicted by an amount that is proportional to the measured metallic-line blocking coefficients. If the strong-line cores were influenced strongly by departures from LTE, this effect would not be expected. After also testing explicitly for non-LTE in strong-line cores, it is concluded that LTE blanketed atmospheres are probably adequate to describe the formation of the spectral lines of the strengths studied. The blanketing effect seriously hampers, however, the uniqueness of the determination of the microturbulent component to the line broadening. From several lines of investigation, for example of the core shape of saturated lines, it appears that the microturbulence peaks to a value of not more than, but probably not much less than, 4 km s$^{-1}$, in mid- to late-A stars. One star shows a total broadening of 4 km s$^{-1}$, and its projected rotational velocity is apparently negligible. Our present estimate disagrees with our previously determined peak value of 7 km s$^{-1}$ determined from curve of growth studies. An analysis of the possible error sources indicates that the discrepancy is mainly due to a combination of errors in the Corliss and Warner scale of oscillator strengths and to probably high equivalent-width scale due to the intermediate (8-9 Å mm$^{-1}$) coudé dispersion used. This work is actually a pilot study in that relatively precise photoelectric data are needed to describe the microturbulent velocity scale unambiguously. Even then, the question of LTE departures and the effect of blanketing on the temperature stratification is intimately tied to the scale of "microturbulence." (auth)

1158 BD−10°4662 INTERPRETED AS A POST-T TAURI STAR. Herbig, G.H. (Lick Observatory, Board of Studies in Astronomy and Astrophysics, University of California, Santa Cruz). Astrophys. J. 182: No. 1, 129-138 (15 May 1973).

BD−10°4662, known to have flared on at least four occasions, has been found to be a close (1″3) double of types about K5p V and K7pV Both stars have H$\alpha$ in emission as well as very strong absorption Li I $\lambda$6707. The radial velocity and the direction of the proper motion indicate an organic connection with a dark cloud about 2° distant which also contains the reddened B2 star HD 170740. At this distance, both components of −10°4662 lie 3-4 mag above the main sequence. It is argued that the components of - 10 °4662 are stars of about 2 $M_{\odot}$, approximately $1–2\times10^5$ years old, that have now evolved to a position near the bottom of the vertical branch of their Hayashi tracks, and hence have already passed through their T Tauri stages. (auth)

**1159** **HYDROGEN LINES IN A AND Ap STARS. I. PHOTOELECTRIC OBSERVATIONS.** Gray, D.F. (Department of Astronomy, University of Western Ontario); Evans, J.C. Astrophys. J. 182: No. 1, 147-158 (15 May 1973).

We present photoelectrically measured profiles of Hγ and Hβ in twelve normal A stars and nine peculiar A stars. The average random error per point is 1.1 percent. Systematic errors appear to be small. We find the functional relation between hydrogen line strength and color indices to be the same for these two groups of stars to within a 1 percent uncertainty. (auth)

**1160** **THE G-BAND ANOMALY OF THE ASYMPTOTIC-BRANCH STARS IN M92.** Zinn, R. (Yale University Observatory, New Haven, Connecticut). Astrophys. J. 182: No. 1, 183-187 (15 May 1973).

An examination of the spectra of 20 giants in M92 revealed that six stars, which are probably asymptotic-branch stars, have anomalously weak G bands in their spectra. Since the weakness of their G bands cannot be explained by effective temperature or surface gravity effects, these stars probably have a low abundance of CH. It is suggested that the low abundance of CH is a result of stellar evolution and may be due to the diffusion of carbon during the blue-horizontal-branch phase. (auth)

**1161** **THERMAL INSTABILITY OF THE HELIUM-BURNING SHELL IN MASSIVE STARS.** Stothers, R.; Chin, C. (Institute for Space Studies, Goddard Space Flight Center, NASA, New York, New York). Astrophys. J. 182: No. 1, 209-214 (15 May 1973).

Nonlinear numerical calculations of stellar evolution at high mass show that thermal instability develops temporarily in the helium-burning shell, shortly after the ignition of shell helium. Manifestation of the instability is an irregular "flickering" of very small amplitude. There appear to be no observable consequences of the phenomenon. (auth)

**1162** **A SIMPLIFIED MODEL FOR OSCILLATORY SECULAR MODES.** Defouw, R.J. (Harvard College Observatory, Cambridge, Massachusetts). Astrophys. J. 182: No. 1, 215-224 (15 May 1973).

A star is considered to consist of two zones, one of which contains a nuclear source. The interaction between the two zones can lead to slow oscillations during which the star remains near hydrostatic equilibrium. The model permits a discussion of the roles played by thermonuclear reactions, radiative heat transport, and hydrostatic adjustment to heat input. Applications are made to stars on the main sequence and to stars with helium-burning shells. (auth)

**1163** **INVESTIGATION OF RZ SCUTI ON LOW-DISPERSION SPECTROGRAMS.** Karetnikov, V.G. (Odessa University). Sov. Astron.–AJ 16: No. 6, 965-970 (May 1973).

RZ Scuti is studied spectrophotometrically, using 83 spectrograms with 166-Å/mm dispersion at Hγ. The spectral energy distribution in the range λλ 3460-6800 Å, spectrophotometric gradients in three wavelength regions, and the Balmer discontinuity are determined. Monochromatic light curves are derived for RZ Scuti and their properties examined. Equivalent widths are measured for hydrogen and other lines, and electron densities are computed by the Inglis-Teller and Unsöld methods. The phase variation of all the parameters is established. The structure of the RZ Scuti binary system is discussed. (auth)

**1164** **PROFILES OF THE PHOTOSPHERIC AND CIRCUMSTELLAR Hα LINE IN THE SPECTRA OF TYPE M SUPERGIANTS.** Orlov, M.Y.; Rodriguez, M.H. (Central Astronomical Observatory, Academy of Sciences of the Ukrainian SSR, Kiev). Sov. Astron.–AJ 16: No. 6, 962-964 (May 1973).

Hα profiles for six M1–M5 supergiants have been derived from high-dispersion spectrograms. Equivalent widths, central depths, and half-widths have been measured. The circumstellar cores of the Hα line are discriminated, yielding their equivalent widths and radial velocities relative to the photosphere. (auth)

**1165** **CHEMICAL COMPOSITION OF THE CLASSICAL CEPHEIDS IN THE GALAXY AND THE MAGELLANIC CLOUDS.** Yakimova, N.N. (Shternberg Astronomical Institute, Moscow). Sov. Astron.–AJ 16: No. 6, 956-961 (May 1973).

From Stobie's theoretical calculations [1–3], preliminary estimates are obtained for the helium abundance in the envelopes of Cepheids in the Galaxy and the Magellanic Clouds. The average He abundance is 40-55%, but large variations are possible, depending on the pulsation period (mass of the star) and the location of the Cepheid. Probably the shorter the period of a galactic or Cloud Cepheid, the lower its exterior He abundance. In the SMC, peripheral Cepheids are considerably less rich than central Cepheids in He and evidently in heavy elements. Old outlying LMC Cepheids exhibit an abnormally low He abundance. (auth)

**1166** **INTENSITY OF SILICON LINES IN THE SPECTRA OF SILICON AP STARS. I. THEORETICAL INTENSITIES.** Khokhlova, V.L.; Krivosheina, A.A. (Astronomical Council, Academy of Sciences of the USSR). Sov. Astron.–AJ 16: No. 6, 952-955 (May 1973).

Calculations of theoretical intensities and effective optical depths of line formation are reported for the lines λ3905.5 Si I, λλ3862, 4128, 4201, 4621 Si II, and λ4552 Si III in main-sequence stellar atmospheres for $T_{eff}=(11–20)\cdot10^3$ °K, log $g=4.0$, microturbulent velocities of 3, 6 and 10 km/sec, and a Si abundance ranging from normal to a 300-fold enhancement. The results will be applied for analyzing the physical conditions and determining the silicon abundance in silicon Ap stars. (auth)

**1167** **EJECTION OF SUPERNOVA ENVELOPES BY MAGNETIC PUMPING.** Amnuél', P.R.; Guseinov, O.K.; Kasumov, F.K. (Shemakha Astrophysical Observatory, Academy of Sciences of the Azerbaidzhan SSR). Sov. Astron.–AJ 16: No. 6, 932-937 (May 1973).

The possibility of explaining type I supernova outbursts in terms of the rotational energy of an existing neutron star is discussed. The envelope would acquire its kinetic energy of expansion through the pressure of a twisted magnetic field formed between the neutron star and the envelope. Calculations show that a supernova-outburst effect can be obtained if $H\simeq r^{-2}$. If the envelope results from rotational instability of the collapsing star, it could be efficiently ejected only for a very high value of the angular momentum of the star. The supernova effect is then readily obtained if the envelope is situated $\simeq10^8$ cm from the neutron star. (auth)

## Quasi-Stellar, Radio, and X-Ray Sources

*Refer also to abstracts 1153 and 1247.*

**1168** (CSIRO-Trans-11260) ELECTROMAGNETIC RADIATION OF A ROTATING MAGNETIC MULTIPOLE. Kaplan, S. A.; Eidman, V. Ya. Translated by G. Losonci from Astrofizika; 7: No. 2, 310-313(1971). 5p. Dep. NTIS (U.S. Sales Only) $3.00.

From a consideration of the magnetic field on the surface or magnetosphere of a rotating pulsar, it is concluded that complex structure of the surface magnetic field or in its vicinity generates radiation at higher harmonics, provided that the number of magnetic spots is sufficiently high. Formation of a pulsar is thought to be accompanied by intense electromagnetic radiation of not very great wavelength providing that the magnetic field structure is sufficiently complex. (MRM)

**1169** γ-RAY BURSTS AND THE DIFFUSE FLUX OF COSMIC X-RAYS. Hillier, R. R. (Univ. of Bristol, Eng.). Nature (London); 245: No. 5422, 201-202(28 Sep 1973).

It is stated that many attempts have been made to explain the diffuse cosmic x-ray flux in terms of contributions from a large number of discrete extra galactic sources, but the nature of these sources has remained obscure. Steady emission from normal galaxies fails by more than an order of magnitude to explain the intensity of the diffuse flux. The spectrum of the diffuse flux can be approximated to a spectrum that is much harder than that of discrete extra galactic sources that have been detected. Observations have recently been reported by Klebesadel (Astrophys. J. Lett. 182, L.85 (1973)) of radiation bursts with hard spectra extending to photon energies >1 MeV, but the author shows that, whatever is the nature of the sources of these bursts, they are unlikely to make a significant contribution to the diffuse flux. The arguments advanced, however, do not exclude a suggestion that the diffuse flux may be due to the superposition of radiation bursts occurring in the early stages of supernova outbursts. (UK)

**1170** WAS THE TUNGUS EVENT DUE TO A BLACK HOLE? Jackson, A. A. IV; Ryan, M. P. Jr. (Univ. of Texas, Austin). Nature (London); 245: No. 5420, 88-89(14 Sep 1973).

It is suggested that a black hole of substellar mass could explain many of the mysteries associated with the Tunguska meteorite. This meteorite showed a fiery trail accompanied by thermal radiation and a blast waste that levelled forest over several hundred square km., but no crater or meteoritic material that can unambiguously be associated with the event has ever been found. It has been estimated that $10^{22}$ to $10^{24}$ ergs, equivalent to a 0.2 to 20 Mton nuclear explosion, would be needed to cause such destruction. In the proposed explanation it is assumed that the black hole had the mass of a large asteroid ($10^{20}$ to $10^{22}$ g). Although the geometric radius of such an object is measured in Angstroms, its Newtonian gravitational field can be quite strong for some distance. The velocity of the black hole is assumed to be slightly greater than Earth escape velocity. Observational parameters for black hole–atmosphere interaction are shown graphically. A shock wave is set up, and the rate of energy deposition into the shock is calculated. If the black hole begins in interstellar space with zero velocity and falls freely to the Earth's orbit it would travel the last 30 km of the atmosphere in about 1 s and the total energy in the blast wave would be $10^{22}$ to $10^{24}$ ergs for masses in the range $10^{20}$ to $10^{22}$ g. The black hole would leave no crater or material residue, and the rigidity of the Earth rock would allow no underground shock wave. Because of its high velocity, and since it loses only a small fraction of its energy in passing through the Earth, the black hole should follow very nearly a straight line through the Earth. Its point of exit from the Earth could provide a check for the hypothesis, since at the exit point there would be another air shock wave, an underwater shock wave, and disturbance of the sea surface. (UK)

1171 HARD X-RAY SPECTRUM OF HERCULES X-1. Manchanda, R. K.; Iyengar, V. S.; Durgaprasad, N.; Gokhale, G. S.; Kunte, P. K.; Sreekantan, B. V. (Tata Inst. of Fundamental Research, Bombay). Nature (London) Phys. Sci.; 244: No. 134, 59-60(23 Jul 1973).

It is stated that spectral results on the periodic pulsating binary x-ray source Hercules X-1 are very meagre. The only available results are from satellite experiments and for energies <40 keV. Uhuru results indicated that the intensity and spectral characteristics vary from day to day. In order to understand the peculiar features observed in this source it is necessary to extend the spectral results and study the temporal variations over different portions of the cycle, observe the finer features of the pulsating component, and determine correlations with the optical intensity variations of the optical counterpart Hz Hercules. With this in view attempts were made to determine the spectral and pulsating characteristics of the source in the 20 to 100 keV band using a balloon-borne x-ray telescope at a time when Her X-1 was near the middle of its "on" state. The x-ray telescope used a NaI (Tl) crystal, and inflight calibration was provided by a $^{241}$Am source. Details are given of the experimental technique and data analysis, and spectral results are shown tabulated. Good agreement was found with the results from OSO 7 in the overlapping energy range of 20 to 40 keV. The photon flux spectrum steepened at higher energies, but all the data above 10 keV could be represented by a single steep spectrum with a power law exponent of about 2. Her X-1 is stated to be bright enough in hard x-rays for more refined experiments to be carried out at balloon altitudes. Detailed analysis for pulsar aspects is in progress. (UK)

1172 CLASSICAL EXAMPLE OF ERGOSPHERE. Denardo, G. (Univ., Trieste, Italy); Treves, A. Lett. Nuovo Cim.; 8: No. 5, 295-298(29 Sep 1973).

An example is examined in which it is possible to introduce the concept of the ergosphere of a black hole in classical language. It is shown that this ergosphere coincides with the one treated by Denardo and Ruffini (1972) in the region of space where the curvature becomes negligible, however, there are some fundamental differences between the classical and the general relativistic cases. (WDM)

1173 PULSE BROADENING DUE TO MULTIPLE SCATTERING IN THE INTERSTELLAR MEDIUM. II. Williamson, I. P. (Cambridge Univ., Eng.). Mon. Notic. Roy. Astron. Soc.; 163: No. 4, 345-356(1973).

A previous paper (Williamson, Mon. Not. R. Astr. Soc.; 157: 55 (1972)) used a simple ray-theory to derive the pulse shapes expected when radiation from a pulsar travels through an extended scattering medium to the observer. This method is here developed to cover the case in which the scattering medium is an extended screen, but source and observer are not necessarily embedded in the medium. Pulse shapes for a model with two thin screens are also derived, and the results for the two models compared. It is found that, for the cases of interest, a knowledge of the pulse shape sets an upper limit to the fraction of the line of sight in the medium. (auth)

1174 ENTROPY MEASURE FOR PARTIALLY POLARIZED RADIATION AND ITS APPLICATION TO ESTIMATING RADIO SKY POLARIZATION DISTRIBUTIONS FROM INCOMPLETE APERTURE SYNTHESIS DATA BY THE MAXIMUM ENTROPY METHOD. Ponsonby, J. E. B. (Nuffield Radio Astronomy Labs., Jodrell Bank, Eng.). Mon. Notic. Roy. Astron. Soc.; 163: No. 4, 369-380(1973).

To apply the maximum entropy method (for obtaining an estimate of a power spectrum from an incomplete estimate of its autocorrelation function) to the task of mapping a radio sky polarization distribution from incomplete "aperture synthesis" data, it is necessary to have a measure of the relative entropy in a polarization map. Such a measure is derived. It allows the change in entropy measure due to a variation in intensity to be compared with that due to a change in the degree of polarization. Using the new measure the variational problem for choosing the maximum entropy estimate of a polarized sky distribution is set up, and some progress is made towards its solution. A field of given mean intensity is found to have maximum entropy measure when it is unpolarized and of uniform brightness. (auth)

1175 CIRCULAR REPOLARIZATION IN COMPACT RADIO SOURCES. Pacholczyk, A. G. (Univ. of Arizona, Tucson). Mon. Notic. Roy. Astron. Soc.; 163: No. 4, 29P-33P(1973).

Generation of circular polarization in the process of transfer of radiation within a compact source, due to the presence of relativistic electrons, is discussed. The interpretation of the observations of polarization of compact radio sources in terms of this mechanism (called "circular repolarization") yields the values of 1 to 10 for the lower limit of the ratio of relativistic to cold electron densities. (auth)

1176 SURVEY OF THE PROPERTIES OF SUPERNOVA REMNANTS. Willis, A. G. Urbana, IL; Univ. of Illinois (1972). 209p. University Microfilms Order No. 73-17,478.

Thesis (Ph. D.).

Sixteen galactic supernova remnants have been mapped at a frequency of 2.7 GHz with the 93 meter radio telescope of the National Radio Astronomy Observatory. The resolution, about 5.2 minutes of arc, is the highest yet attained on many of the sources. Additional observations of some of the remnants have been made at a frequency of 1665 MHz with the 37 meter telescope of the Vermilion River Observatory. The 2.7 GHz measurements are combined with other data available in the literature in order to search for common characteristics of the remnants and evidence of source evolution. Except for the supernova remnant HB 21, good positional correspondence between the region of the peak volume emissivity at 2.7 GHz and the site of the optical filaments is found in those remnants exhibiting optical emission. Analysis of a large number of remnants showing shell structure demonstrates that the mean intensity profile of most of the sources does not agree with that expected from an optically thin spherically symmetric shell source whose volume elements radiate isotropically. The large shell thickness/source radius ratio found in many of the old remnants contradicts the small ratio required by current models describing the evolution of the radio emission from supernova remnants. It is suggested that a model of supernova remnant evolution which includes macroscopic turbulence in the shell where the radio emission originates would be in better agreement with the observed data. (Diss. Abstr. Int., B)

1177 ACCRETION ONTO BLACK HOLES: THE EMERGENT RADIATION SPECTRUM. Shapiro, S. L. Princeton, NJ; Princeton Univ. (1973). 71p. University Microfilms Order No. 73-23,218.

Thesis (Ph. D.).

The total luminosity and frequency spectrum of radiation resulting from interstellar gas accreting onto a black hole are calculated. The model is that of spherically symmetric, steady state accretion onto a nonrotating black hole at rest in the interstellar medium. The treatment of the fluid mechanics and radiation processes is fully relativistic, incorporating both special and general relativity. (WDM)

1178 HIGH RESOLUTION OBSERVATIONS OF THE EXTRAGALACTIC RADIO SOURCES 3C 52 AND 3C 192. Harris, A. (Cambridge Univ., Eng.). Mon. Notic. Roy. Astron. Soc.; 163: No. 4, 19P-23P(1973).

3C 52 and 3C 192 have been mapped at 2.7 and 5 GHz with the Cambridge One-Mile telescope. 3C 52 is a double source with evidence of misaligned structure in the components; with lower resolution 3C 192 appeared to have complex structure but the present observations show two compact components linked by extensive regions of low brightness. (auth)

1179 MONTE CARLO ANALYSIS OF THE RADIO SOURCE COUNTS FROM THE OHIO SURVEY AT 1415 MHz. Ramakrishna, C. M. Columbus, OH; Ohio State Univ. (1973). 208p. University Microfilms Order No. 73-18,942.

Thesis (Ph. D.).

A Monte Carlo analysis was made to determine the errors in flux density and position of radio sources in the Ohio Survey. The corrections to the flux density found were applied to correct the radio source counts from the Ohio Surveys II through V. (WDM)

1180 SIMPLIFIED PHOTOIONIZATION ANALYSIS OF QUASAR EMISSION SPECTRA. Davidson, K. (Princeton University Observatory). Astrophys. J. 181: No. 1, 1-14 (1 Apr 1973).

Simplified photoionization calculations, considering quasar emission lines with ultraviolet rest-wavelengths, can be made including only hydrogen, helium, and carbon ions. With plausible assumptions about the helium abundance and ionizing spectral slope, estimates of the (radiation/gas) pressure ratio and carbon abundance are possible.

Proportionality relations, showing the dependences of line ratios upon assumed parameters, may be useful in considering differences between individual spectra. (auth)

1181 PULSAR MAGNETOSPHERES, BRAKING INDEX, POLAR CAPS, AND PERIOD–PULSE–WIDTH DISTRIBUTION. Roberts, D.H.; Sturrock, P.A. (Institute for Plasma Research, Stanford University). Astrophys. J. 181: No. 1, 161-180 (1 Apr 1973).

Recent studies indicate that pulsar magnetospheres may contain nonrelativistic material in amounts sufficient to alter drastically the magnetic–field configuration. The most important change in the magnetosphere is to move the boundary between open and closed field lines from the light cylinder into a region located at $r \approx R_{FB}$. The "force–balance radius" $R_{FB}$ is the radius at which the centrifugal and gravitational forces cancel, and is always much less than the radius of the light cylinder. We have constructed approximate models for the magnetic field structure, considering in detail the aligned and orthogonal cases. If the magnetic field is initially closed (out to the light cylinder), gas will collect where there is "microscopic stability." Such locations exist for $r \gtrsim R_{FB}$. Most of this region is "macroscopically unstable" since, when sufficient gas is collected, the centrifugal force overcomes the magnetic stress and converts closed field lines into open field lines. However, there is a small region near $r=R_{fb}$, both microscopically and macroscopically stable, where gas can collect and remain. Such a magnetospheric structure leads to a braking index $n=7/3$, in good agreement with the observed braking index of the Crab pulsar. We calculate the polar–cap boundaries, and the resulting period–pulse–width distribution agrees well with observational data. It is suggested that the accumulation of gas and the occurrence of instabilities can explain the timing irregularities ("noise") and glitches observed in the Crab pulsar (auth)

1182 NONRADIAL PULSATION OF GENERAL–RELATIVISTIC STELLAR MODELS. VI. CORRECTIONS. Ipser, J.R. (University of Chicago); Thorne, K.S. Astrophys. J. 181: No. 1, 181-182 (1 Apr 1973).

The equations governing the nonradial pulsations of general–relativistic stellar models are shown to form a fourth–order system, rather than a fifth–order system as was believed previously. Incorrect statements about the application of boundary conditions at the stellar surface are also rectified. The errors corrected here do not invalidate any of the final results obtained in previous papers of this series. (auth)

1183 ARE THERE TWO TYPES OF QUASARS?. Chiu, B.C.; Morrison, P. (Department of Physics and Center for Space Research, Massachusetts Institute of Technology); Sartori, L. Astrophys. J. 181: No. 2, 295-303 (15 Apr 1973).

It has been claimed that associations in the plane of the sky between a few quasars and bright galaxies show a causal connection. Even if we accept for the sake of argument the validity of this statistically based relation, it is still possible to avoid the introduction of any new physical origin for the quasar redshifts. One postulates two types of quasars: Type I, the vast majority of quasars, are highly luminous and cosmologically distant, as shown by their redshifts. The second type, a dwarf branch, are products of a few remarkable explosions in nearby galaxies. We show that this hypothesis is consistent with association and red–shift statistics, maintains the physical unity of categories of objects as well as does the single–type model, and suggests a possible interpretation of such objects as BL Lac and OJ 287. (auth)

1184 REDSHIFT–MAGNITUDE BANDS, QUASI–STELLAR SOURCES, AND SYSTEMS OF REDSHIFT. Tifft, W.G. (Steward Observatory, University of Arizona, Tucson). Astrophys. J. 181: No. 2, 305-326 (15 Apr 1973).

The visibility and character of redshift–magnitude bands in a diagram of general field galaxies compared to specific clusters depends upon the cosmological model. In the normal expanding universe model where galaxies have lives comparable to the age of the universe, no band structure should be visible outside of clusters. Band structure is, however, shown to exist among quasi–stellar sources and to show the identical slope and band spacing characteristics as do the galaxies in the Coma cluster. At least 14 bands can be identified, forming a convergent band series among QSS emission–line objects. The validity of the band phenomenon is tested by power–spectrum analysis and shown to be highly significant. The distribution of points about the band structure is Gaussian. Cross–projections of the band system are shown to give rise to harmonic periodicities which may explain periodicities observed in the z distribution of QSSs. The Coma galaxy band system is a scaled version of the QSS band system. Galaxies appear to occupy a separate band system which converges to the start of the QSE system. QSS absorption–line objects may form a third independent band system beginning at the high–redshift limit of the QSS emission line system. The band phenomenon is briefly discussed in terms of a model invoking multiple states of matter, rapid galaxy evolution, and possible time evolution of matter observed as a function of look–back time in a singular–origin Universe. (auth)

1185 THE RADIAL VELOCITIES OF SEG STARS AND THE DISTANCE TO SCORPIUS X–1. Felten, J.E.; Humphreys, R.M. (Steward Observatory, University of Arizona, Tucson). Astrophys. J. 181: No. 2, 543-546 (15 Apr 1973).

Contrary to an earlier report, the radial velocities of stars SEG 13, 25, and 37 eliminate them as probable members of the Sco–Cen association. The proper–motion argument identifying Sco X–1 as an association member is therefore invalid. A distance $D \approx 0.4$–1 kpc for Sco X–1 seems most acceptable at present. Further work on the optical and X–ray absorption is needed. (auth)

1186 ON THE APPARENT ASSOCIATION OF QUASI–STELLAR OBJECTS WITH CLUSTERS OR GROUPS OF GALAXIES WITH ABOUT THE SAME REDSHIFT. Burbridge, G.R.; O'Dell, S.L. (Department of Physics, University of California, San Diego). Astrophys. J. Lett. 182: No. 2, L47-L51 (1 June 1973).

The statistical evidence for the association of QSOs with clusters or groups of galaxies of about the same redshift is examined. It is shown that, due to the uncertainty in the number density of cluster centers for all but moderately rich compact clusters, it is premature to conclude that the present evidence for the assoication of QSOs with such groups or clusters is statistically significant. (auth)

1187 ON THE CHARACTER OF OPTICAL VARIABILITY OF THE QUASAR 3C 273. Chertoprud, V.E. (Astronomical Council, USSR Academy of Sciences, Moscow); Gudzenko, L.I.; Ozernoy, L.M. Astrophys. J. Lett. 182: No. 2, L53-L56 (1 June 1973).

We discuss the results of recent works referring to "slow" ($\approx$10 years) brightness variations of the quasar 3C 273, as well as the pertinent observational data. The validity of our earlier conclusion that the light curve of 3C 273 is incompatible with the model of independent random pulses is confirmed in a new way. (auth)

1188 VARIATIONS IN THE RADIO STRUCTURE OF BL LACERTAE. Clark, B.G.; Kellermann, K.I. (National Radio Astronomy Observatory, Associated Universities, Inc.); Cohen, M.H.; Shaffer, D.B.; Broderick, J.J.; Jauncey, D.L.; Matveyenko, L.I.; Moiseev, I.G. Astrophys. J. Lett. 182: No. 2, L57-L60 (1 June 1973).

We have observed the structure of the rapid variable radio source BL Lac (VRO 42.22.01) using long baseline interferometer systems with baselines up to 266 million wavelengths. Despite large variations in the total flux and in the overall size of this source, it has maintained an elongated brightness distribution, and the direction of elongation has not changed during the 1.3 years of observation. No simple model of stationary variable components or of separating, evolving components appears to fit all the data for this source. In particular, it apparently cannot be explained in terms of a stationary brightness distribution with a single variable component of very small angular size. The peak brigntness temperature of VRO 42.22.01 is in excess of $5 \times 10^{12}$ °K at 11 cm wavelength, a value close to the limit set by inverse Compton scattering. (auth)

1189 ZEEMAN EFFECT IN THE X–RAY STAR CANDIDATES HD 77581 AND $\theta^2$ ORIONIS. Kemp, J.C.; Wolstencroft, R.D. (Institute for Astronomy, University of Hawaii). Astrophys. J. Lett. 182: No. 1, L43-L46 (15 May 1973).

The discovery of Zeeman effects is reported in HD 77581 and $\theta^2$ Orionis, optical candidates for the X–ray sources Vela XR–1 and 2U 0525–06, respectively. The maximum longitudinal magnetic fields recorded were –10,000 gauss in HD 77581 and +1500 gauss in $\theta^2$ Ori. Various polarimetric data are also given, including evidence for a variable linear polarization in HD 77581. (auth)

1190 RADIO VARIABILITY OF HDE 226868 (CYGNUS X–1). Hjellming, R.M. (National Radio Astronomy Observatory, Green Bank, West Virginia). Astrophys. J. Lett. 182: No. 1, L29-L31 (15 May 1973).

Radio observations of HDE 226868 (Cyg X–1) at 2695 and 8085 MHz made between 1971 February 23 and 1972 October 21 show that (1) the radio flux of this spectroscopic binary went from less than 0.005 f.u. on 1971 March 22 to 0.02 f.u. on 1971 March 31, just as the X–ray flux of Cyg X–1 was beginning a significant change in average level; (2) a significant change from a mean level of 0.015 f.u. to 0.018 f.u. occurred at both frequencies between 1972 April 25 and 1972 September 3; and (3) radio variability on a time scale of days definitely occurred during October 1972 and may have occurred at other times. (auth)

1191 X–RAY PULSE PROFILE AND CELESTIAL POSITION OF HERCULES X–1. Doxsey, R.; Bradt, H.V.; Levine, A.; Murthy, G.T.; Rappaport, S.; Spada, G. (Physics Department and Center for Space Research, Massachusetts Institute of Technology). Astrophys. J. Lett. 182: No. 1, L25-L28 (15 May 1973).

The celestial position of the binary X–ray source Her X–1 has been measured with a precision of 30″ and, within the uncertainties, agrees with the position of the optical variable HZ Herculis. An average light curve for the 1.24–s periodicity has been obtained with $\approx$10 ms resolution. The average pulse is a double–peaked structure which shows significant intensity changes in time scales down to 30 ms. (auth)

**1192** MAGNETIC FIELDS OF PULSARS. Chanmugam, G. (Department of Physics and Astronomy, Louisiana State University, Baton Rouge). Astrophys. J. Lett. 182: No. 1, L39-L41 (15 May 1973).

It is shown that one cannot neglect time variations in the magnetic fields of pulsars if one hopes to understand detailed pulsar observations. (auth)

**1193** ASTROPHYSICAL MASERS. III. TRAPPED INFRARED LINES AND CROSS–RELAXATION. Goldreich, P. (California Institute of Technology, Pasadena); Keeley, D.A.; Kwan, J.Y. Astrophys. J. 182: No. 1, 55-66 (15 May 1973).

Infrared line radiation trapped between a maser level and other rotational levels produces a rapid relaxation among the degenerate substates of the maser level. The rate of this relaxation is comparable to the spontaneous decay rates of the infrared transitions. This cross–relaxation has important effects on the apparent source sizes and the polarization properties of interstellar masers. It also affects the relative amplification of the components of a hyperfine–split maser line. The effect on apparent source size is pronounced when the cross–relaxation rate $\gamma$ exceeds the decay rate of the maser levels. In this limit, cross–relaxation enables maser radiation directed in a narrow solid angle to saturate the population excess in all magnetic sublevels. This property is essential to the arguments which suggest that the apparent sizes of interstellar OH and $H_2O$ masers are much smaller than their physical sizes. Cross–relaxation has an important effect on the polarization of radiation emitted by saturated masers if the relaxation rate $\gamma$ is greater than the stimulated emission rate R. For cases in which the Zeeman splitting $g\Omega$ is greater than the maser line width $\Delta\omega$ the maser amplifies the Zeeman pattern. In the presence of rapid cross–relaxation ($\gamma > R$), the rates of amplification of the $\sigma$– and $\pi$–components of the Zeeman pattern are unequal and depend upon the angle between the propagation direction and the magnetic field. For $R < g\Omega < \Delta\omega$, the limiting maser polarization is linear. However, cross–relaxation suppresses the growth of linear polarization until and unless the stimulated emission rate becomes as large as the relaxation rate. (auth)

**1194** PULSAR FLUCTUATION SPECTRA AND THE GENERALIZED DRIFTING–SUBPULSE PHENOMENON. Backer, D.C. (National Astronomy and Ionosphere Center, Arecibo, Puerto Rico). Astrophys. J. 182: No. 1, 245-276 (15 May 1973).

The variation with longitude of the fluctuation spectrum of pulsar radio emission from a fixed longitude is discussed for 13 pulsars. In particular, features in the fluctuation spectra are quantified. These measurements are found to be properties of the pulsar which are as stable in time and as constant over a range of frequencies as the pulse profile and polarization properties. It has been shown that in 1919+21 the well–defined feature at 0.23 cycles per pulse period results from a drifting–subpulse phenomenon. In 2016+28 a poorly defined feature is caused by similar drifting–subpulse behavior. Thus it is suggested that the similar fluctuation spectrum features of other pulsars arise from the same subpulse phenomenon, generalized sufficiently to include all objects. Three variants of this generalized drifting–subpulse phenomenon are described. These are found to be related to the apparent magnetic dipole moments which are inferred from pulsar spin–downs. A qualitative discussion of the role of intensity fluctuations in various pulsar models is given. (auth)

**1195** GALAXY–QUASAR PAIRING. Ozernoi, L.M. (Lebedev Physics Institute, Academy of Sciences of the USSR). Sov. Astron.–AJ 16: No. 6, 938-940 (May 1973).

The relation between the angular distance of a quasar from a nearby galaxy and the red shift of the galaxy, as found by Burbidge, O'Dell, and Strittmatter for five galaxy–quasar pairs, disappears if one takes a more complete sample of paired systems. Previous statistical conclusions that a random correlation exists between the apparent positions of compact objects and galaxies thereby remain valid. (auth)

**1196** VARIABILITY OF X RAYS FROM BLACK HOLES WITH ACCRETION DISKS. Syunyaev, R.A. (Institute of Applied Mathematics, Academy of Sciences of the USSR, Moscow). Sov. Astron.–AJ 16: No. 6, 941-944 (May 1973).

If hot spots occur on the surface of a disk of material being accreted by a collapsar (black hole), then x rays received from the disk should exhibit a characteristic quasiperiodic variability. Such spots could arise either from turbulent convection or from the closure of magnetic field lines (as in solar flares). The lifetime of a spot and the duration of its radial motion toward the black hole could far exceed its orbital period, serving to stabilize the pulsations. The minimum pulsation period for the radiation from a disk with a hot spot should be eight times as short for a rotating as for a nonrotating black hole of the same mass. The detection of rapid quasiperiodic pulsations with a period T $\simeq 10^{-4}$–$10^{-2}$ sec might help to clarify the nature of fluctuating x–ray sources, to identify black holes among them, and most importantly, to discriminate between cases where a Schwarzschild or a Kerr metric prevails. (auth)

**1197** STIMULATED AMPLIFICATION OF SYNCHROTRON RADIATION IN COSMIC SOURCES. Sazonov, V.N. (Lebedev Physics Institute, Academy of Sciences of the USSR). Sov. Astron.–AJ 16: No. 6, 971-975 (May 1973).

A discussion is given of the stimulated amplification of synchrotron radiation in a system of relativistic electrons in a magnetic field due to an anisotropic angular distribution of the electrons. If the radiation is propagated perpendicular to the magnetic field, amplification will be possible provided that the radiation is linearly polarized parallel to the field and the momenta of all the electrons form an angle less than $\Delta$ with the plane perpendicular to the field, $\Delta \ll 1$. In objects such as pulsars, UV Ceti flare stars, and certain other sources, a substantial amplification of radiation could take place with quite plausible values for the magnetic–field strength, the density and energy of the relativsitic electrons, and the quantity $\Delta$ (see Table 1). (auth)

**1198** QUASIRADIAL PULSATION OF ROTATING WHITE DWARFS AND NEUTRON STARS IN GENERAL RELATIVITY. Arutyunyan, G.G.; Sedrakyan, D.M.; Chubaryan, E.V. (Erevan University). Sov. Astron.–AJ 16: No. 6, 983-985 (May 1973).

The quasiradial–pulsation frequencies of white dwarfs and neutron stars are calculated on the basis of relativistic gravitation theory. In the white–dwarf range the results are entirely similar to the Newtonian case. For neutron stars the relativistic rotation correction offsets the positive contribution of Newtonian rotation to the squared frequency $\sigma^2$ at the point where dynamical stability breaks down. (auth)

# Solar Phenomena

*Refer also to abstracts 1100, 1275, 1290, and 1617.*

**1199** SOLAR NEUTRAL IRON SPECTRUM. I. Measurement of Solar Fe I Line Profiles From Center to Limb. Lites, B. W. (High Altitude Observatory, Boulder, CO); Brault, J. W. Solar Phys.; 30: No. 2, 283-300(Jun 1973).

Mean profiles of eighteen neutral iron lines of varying strengths were measured at selected positions from the center of the solar disk to the limb. These profiles were obtained by rapid photoelectric scanning of the spectrum with a double-pass spectrometer. The Fe I lines selected are representative of most of the stronger low-lying transitions in the neutral iron atom. In addition to the iron lines, this observational program includes center-to-limb measurements of three Ti II lines and of the Ca I resonance line $\lambda$4226.7. The line profiles are presented here in graphical form after correction for instrumental effects and normalization to the local disk center continuum. (auth)

**1200** SOLAR ABUNDANCE OF THORIUM AND LEAD. Hauge, O.; Sorli, H. (Univ. of Oslo). Solar Phys.; 30: No. 2, 301-308(Jun 1973).

Two new Th II lines have been identified in the spectrum of the solar photosphere. The abundance derived from these lines together with the previously known Th II line at 4019 Å, is log $\epsilon_{Th}$ = 0.85 ± 0.20 in the log $\epsilon_H$ = 12.00 scale. Analysis of three Pb I lines in the photospheric spectrum resulted in an abundance of log $\epsilon_{Pb}$ = 1.90 ± 0.10. The solar Th/Pb ratio is $0.09^{+0.09}_{-0.05}$. (auth)

**1201** CONVECTIVE INSTABILITY IN A COMPRESSIBLE ATMOSPHERE. Chitre, S. M. (Goddard Space Flight Center, New York); Gokhale, M. H. Solar Phys.; 30: No. 2, 309-318 (Jun 1973).

The degree of convective instability, as expressed by the growth rate $\omega$ of linear modes, is calculated for a plane parallel polytropic atmosphere in the presence of radiative damping, without using Boussinesq approximation. A comparison with the results based on the Boussinesq approximation reveals that the use of the Boussinesq approximation leads to an overestimation of the radiative damping. The computation of $\omega$ as a function of the horizontal wave number yields a wavelength of maximal instability under a variety of conditions. For reasonable choices of physical parameters appropriate to the solar atmosphere, the fastest growing wavelengths turn out to be in the range 600 to 1200 km, and their e-folding times are in the range 200 to 2000 s. (auth)

**1202** RADIATIVE DAMPING OF TRAPPED GRAVITY WAVES IN THE SOLAR ATMOSPHERE. Clark, P. A. (Univ. of Rochester, NY); Clark, A. Jr. Solar Phys.; 30: No. 2, 319-325(Jun 1973).

The radiative damping of trapped gravity waves in an optically thin atmosphere is studied for a stratified Boussinesq fluid. The character of the atmospheric eigenmodes depends on the distribution of the Brunt–Väisälä frequency N and the radiative relaxation time $\tau$. The calculations for simple layer models show that if $N\tau$ is large over some finite fraction of the trapping region, then modes of long lifetime can exist. In order to suppress gravity waves entirely, it is necessary that $N_\tau \lesssim 1$ over the entire trapping region. Qualitative application of the results to the solar atmosphere leads to the conclusion that gravity wave eigenmodes of the solar atmosphere, although damped, are by no means eliminated by radiative effects. (auth)

**1203** FURTHER ASPECTS OF WEAK SHOCK THEORY APPLIED TO THE SOLAR CHROMOSPHERE. Jordan, S. D. (Goddard Space Flight Center, Greenbelt, MD). Solar Phys.; 30: No. 2, 327-334(Jun 1973).

The low chromosphere now seems definitely to require mechanical heating, and dissipation of initially acoustic waves by shocking is one of the most promising possibilities. Results of recent calculations indicate that the weak shock theory may be applicable here, but discrepancies exist among various applications of this theory, and the explanations offered to date are not completely satisfactory. It is shown here that the different approximations used by different authors to evaluate the mechanical flux integral play an important role in producing these discrepancies, in addition to the already well known effects of the density scale heights and the wave periods. Arguments are presented favoring Ulmschneider's method for evaluation of this flux integral. (auth)

**1204** COMMENTS ON THE PHOTOGRAPHIC SUBTRACTION METHOD OF DETERMINING CHROMOSPHERIC VELOCITIES. Bray, R. J. (National Standards Lab., Sydney). Solar Phys.; 30: No. 2, 335-344(Jun 1973).

The photographic subtraction formula expressing the "Doppler signal" in terms of line-of-sight velocity is rederived and the conditions governing its validity are carefully stated. By appealing to the observed profiles of individual bright and dark mottles it is shown that, in the case of H$\alpha$ observations of the quiet chromosphere, two essential conditions are violated. An analysis based on Beckers' (1964) theoretical mottle profiles shows that, assuming the correctness of this model, the photographic subtraction method correctly maps regions of zero velocity and, provided the original photographs are taken sufficiently far from the center of H$\alpha$, gives the correct signs of any line-of-sight velocities present. However, at H$\alpha \pm 0.25$ Å the method gives inconsistent signs. Moreover, at all wavelengths in the line the magnitude of the Doppler signal depends not only on velocity but also on the source function S, optical thickness $t_0$, and line broadening parameter $\Delta\lambda_0$. Accordingly, there is no one-to-one correspondence between velocity and the Doppler signal since S, in particular, shows considerable variation from place to place over the quiet chromosphere. An alternative procedure which obviates these difficulties is suggested. It is also based on Beckers' model and yields a calibrated measure of the velocity in terms of $\Delta\lambda_0$ (assumed constant) which is independent of spatial variations in S and $t_0$. (auth)

**1205** ROCKET MEASUREMENT OF SOLAR FLUXES AT 1216 Å, 1450 Å, AND 1710 Å. Ackerman, M.; Simon, P. (Institut d'Aeronomie Spatiale de Belgique, Brussels). Solar Phys.; 30: No. 2, 345-350(Jun 1973).

Values of the solar uv flux at 1216, 1450, and 1710 Å obtained by means of rocketborne spectrometers are presented. They are compared with other results. (auth)

**1206** LAMBDA 10747 CORONAL LINE AT THE 1966 ECLIPSE. I. Emission Line Polarization. Eddy, J. A.; Lee, R. H.; Emerson, J. P. (High Altitude Observatory, Boulder, CO). Solar Phys.; 30: No. 2, 351-369(Jun 1973).

Observations are presented of emission line resonance polarization in Fe XIII $\lambda$10747 at the total solar eclipse of November 12, 1966. Useful data, with angular resolution 15 in., describe three quadrants of the corona from 1.08 $R_\odot$ to a maximum of 1.6 $R_\odot$. The direction of the electric vector of observed polarization is perpendicular to the solar limb, to the limits of accuracy of measurement, in at least 74% of all cases. Departures in the other points are consistent with the magnetic depolarization expected from the nonradial fields of streamers. Polarizations observed range from near zero at the limb to 80% and higher at 1.6 $R_\odot$. Averaged polarization is highest in nonstreamer regions, where above 1.2 $R_\odot$ it suggests pure radiative excitation of the $\lambda$10747 line. Below 1.2 $R_\odot$, and in a dense streamer, the polarization is significantly depressed, indicating dominant collisional excitation of the line wherever the electron density exceeds $50 \times 10^6$ cm$^{-3}$. (auth)

**1207** PROTON COLLISIONAL EXCITATION IN THE GROUND CONFIGURATION OF Fe$^{+12}$. Landman, D. A. (Univ. of Hawaii, Honolulu). Solar Phys.; 30: No. 2, 371-380(Jun 1973).

Values of the proton collisional excitation and deexcitation cross sections for all transitions between the Fe$^{+12}$ ground configuration levels are calculated using semi-classical Coulomb excitation theory. Rate constants for these processes are then derived for coronal temperatures and are shown to be comparable in all cases to the corresponding electron rate constants. (auth)

**1208** THEORETICAL INTENSITY RATIOS FOR SOME Fe XIII CORONAL LINES. Finn, G. D.; Landman, D. A. (Univ. of Hawaii, Honolulu). Solar Phys.; 30: No. 2, 381-384(Jun 1973).

Theoretical values for the relative intensities of the Fe XIII lines $\lambda$10747, $\lambda$10798, and $\lambda$3388 are presented as functions of electron density using recent values of the cross-section for collisional excitation by protons. The results are compared with those of Chevalier and Lambert. (auth)

**1209** OBSERVATION OF A POSSIBLE NEUTRAL SHEET IN THE CORONA. Eddy, J. A. (High Altitude Observatory, Boulder, CO). Solar Phys.; 30: No. 2, 385-394(Jun 1973).

A linear coronal ray, centered on a large helmet, is prominent in white-light photographs taken at the 1922 eclipse. It extends from near the limb to 4 $R_\odot$, has minimum width 9 in. arc, and persisted for at least 35 min. Examination reveals that the ray marks the cleavage between the domes of a twin-arch streamer which in turn is associated with two large, distinct chromospheric active regions. The ray is interpreted as the edge-on aspect of a coronal neutral sheet which separates areas of presumed opposite magnetic polarity in the two surface regions. (auth)

**1210** STUDY OF SOLAR RADIO EMISSION IN THE LIGHT OF SENGUPTA'S MODEL OF CORONAL ACTIVE REGIONS. Sengupta, P. R.; Chakraborty, A. K. (Tripura Engineering Coll., India). Solar Phys.; 30: No. 2, 395-401(Jun 1973).

Daily solar radio flux at six different frequencies in dm, cm, and mm wavelength regions has been studied for 182 days from December 1, 1970 to May 30, 1971. It is found that the slowly varying component of the centimeter wave emission correlates well with the physical model of the coronal active regions derived by Sengupta (Sengupta, 1971b) from which, as he showed earlier, most of the solar soft x rays of wavelength less than 20 Å comes. It is also found that the cm wave emission is consistent with the assumption that the emitting regions are optically thin in this wavelength range. Emissions in dm and mm wavelength ranges, however, show poor correlation with the physical model of the soft x-ray emitting regions. It is concluded that the preferred regions of cm wave emission are located in the same region of solar corona from where most of the soft x rays come but are different from the preferred regions of mm and dm emission. (auth)

**1211** GENERATION OF UMBRAL FLASHES AND RUNNING PENUMBRAL WAVES. Moore, R. L. (Hale Observatories, Pasadena, CA). Solar Phys.; 30: No. 2, 403-419(Jun 1973).

From a review of the observed properties of umbral flashes and running penumbral waves it is proposed that the source of these periodic phenomena is the oscillatory convection which Danielson and Savage (1968) and Savage (1969) have shown is likely to occur in the superadiabatic subphotospheric layers of sunspot umbras. Periods and growth rates are computed for oscillatory modes arising in a simple two-layer model umbra. The results suggest that umbral flashes result from disturbances produced by oscillatory convection occurring in the upper subphotospheric layer of the umbra where the superadiabatic temperature gradient is much enhanced over that in lower layers, while running penumbral waves are due to oscillations in a layer just below this upper layer. (auth)

**1212** TOPOLOGICAL ASSOCIATION OF H$\alpha$ STRUCTURES AND MAGNETIC FIELDS. Nakagawa, Y. (High Altitude Observatory, Boulder, Co); Raadu, M. A.; Harvey, J. W. Solar Phys.; 30: No. 2, 421-437(Jun 1973).

The topological associations between H$\alpha$ structures and magnetic fields are examined for an active region observed on two different dates. The structures seen in the on and off band of H$\alpha$ filtergrams are compared with the contour maps of magnetic fields at the level of magnetogram observations. Similar comparisons are made also with the configurations of force-free magnetic lines of force at various heights evaluated with the use of formulations developed previously by Nakagawa and Raadu (1972). Among the results of significance, it is noted that (1) H$\alpha$ plages could be identified with regions of magnetic field larger than ± 80 G, (2) the network of bright dots seen in H$\alpha - 1$ Å filtergrams follow closely ± 80 G contours, (3) stable prominences lie along either neutral lines or valleys of magnetic fields, (4) the configuration of magnetic lines of force shows discrete domain structures suggesting bipolar nature of local magnetic fields, and (5) within a domain the configuration is governed apparently by evaluational consequences. Details of analyses are described with discussions on the limitations and possible future improvements. (auth)

**1213** SPATIAL RELATIONSHIP BETWEEN $\lambda$5303 AND H$\alpha$ COMPONENTS OF A LOOP PROMINENCE SYSTEM. McCABE, M. K. (Univ. of Hawaii, Honolulu). Solar Phys.; 30: No. 2, 439-448(Jun 1973).

There are remarkable similarities in the structure of loop prominences when observed in H$\alpha$ and coronal lines, although the lines arise from extremely different excitation conditions. This leads to the consideration of a multi-component model, where different emission lines come from different elements of the structure. The late phases of a large west limb loop prominence system followed by a surge were recorded at Haleakala Observatory on March 6, 1970. Simultaneous filtergrams in H$\alpha$ and $\lambda$5303 were obtained, together with spectra at three heights in the prominence over the range 3850 to 5950 Å. The positions of bright knots of emission as seen in the green line are compared with associated H$\alpha$ knots. With these relative positions determined, the filtergrams are superimposed to demonstrate the two dimensional spatial relationship between H$\alpha$ and $\lambda$5303 structures. The results support a model of cool loops within a closely associated hot loop system. (auth)

**1214** STATISTICAL PROPERTIES OF ELLERMAN BOMBS. Roy, J. R. (Univ. of Western Ontario, London); Leparskas, H. Solar Phys.; 30: No. 2, 449-457(Jun 1973).

One hundred seventy-eight Ellerman bombs were identified and studied with on- and off- band H$\alpha$ filtergrams of two active centers, one near disk center and the other near the east limb. The photographs, taken through a $\frac{1}{4}$ Å bandpass filter, occasionally attained resolution as fine as 0.3 in. The mean duration of bombs at H$\alpha$ − 2 Å was about 13 min near disk center and 11 min near the limb; these times increase slightly closer to the core of H$\alpha$. Eighty-six percent of the bombs in the near-limb region and 56% in the disk-center region were seen to be accompanied by ejections of dark material; the ejections were 3 to 30 in. long. The ejection length appears to be proportional to the bomb size times the bomb lifetime. (auth)

**1215** WHY SYROVATSKII'S MECHANISM OF DYNAMIC DISSIPATION OF MAGNETIC FIELDS DOES NOT WORK. Anzer, U. (Max Planck-Institut fuer Physik und Astrophysik, Munich). Solar Phys.; 30: No. 2, 459-471(Jun 1973).

Syrovatskii's mechanism of 'dynamic dissipation of magnetic field' is reinvestigated. In order to have this kind of "dynamic dissipation" at a neutral line the ratio of current density to particle density must exceed a certain critical value. For conditions in the solar atmosphere near sunspots, this value can only be reached by a mechanism which produces a very large compression of the magnetic field as well as an extreme rarefaction of the density. Syrovatskii claims that his mechanism provides both these features. His enormous field compression, however, can only be obtained if one neglects the restoring Lorentz force (e.g. in Syrovatskii's model the compressed field near the neutral line is about one order of magnitude larger than the field of the sunspots which generates it). The second effect, i.e. the large plasma rarefaction around the neutral line, also is not real. This rarefaction is due to the particular flow field of Syrovatskii's model which allows for a free reconnection of the field lines across the neutral line; the magnetic field is treated like a vacuum field, the effects of the field accumulation near the neutral line being neglected. The aim of the present paper is to show how more realistic models modify Syrovatskii's results. The numerical calculations lead to a maximum current to density ratio which is a factor of $10^6$ smaller than the one obtained by Syrovatskii. Therefore one has to conclude that in the solar atmosphere one cannot produce in the way described by Syrovatskii the configurations which are necessary for "dynamic dissipation". (auth)

**1216** HIGH RESOLUTION STUDY IN TIME, POSITION, INTENSITY, AND FREQUENCY OF THE RADIO EVENT OF JANUARY 14, 1971. Caroubalos, C. (Observatoire de Paris, Meudon, France); Pick, M.; Rosenberg, H.; Slottje, C. Solar Phys.; 30: No. 2, 473-488(Jun 1973).

A high resolution study in time, frequency, position, and intensity was made at 169 MHz and neighboring frequencies of the solar radio event of January 14, 1971, $11^{h}20^{m}-30^{m}$ UT. The event consisted of two closely resembling groups of type III bursts and type II like details. Before, during, and after the outburst a stationary type IV continuum was seen, with small amplitude pulsating structure. The size of the pulsating structure (which was located inside the continuum) was considerably smaller than the continuum size, and in agreement with an explanation by fluctuating magnetic inhomogeneities inside the continuum source. The continuum moved outward after each outburst at a high speed (2−4000 km $s^{-1}$). After the second event the continuum source returned inward slowly ( ≈450 km $s^{-1}$). The outward motion is discussed. It can be explained by a combination of the impact of a fast magnetohydrodynamic shock and the injection of highly energetic particles during the event, the required number being also necessary to account for the observed radio flux. The slow returning motion can be related to mhd restoring of the magnetic field configuration. (auth)

**1217** OBSERVATION OF LINEAR POLARIZATION OF SOLAR MICROWAVE BURSTS. Magun, A.; Maetzler, C. (Univ., Bern). Solar Phys.; 30: No. 2, 489-496(Jun 1973).

It is known that mode coupling may occur in quasi-transverse magnetic field regions of the solar corona, which produces linear polarization at microwave frequences. A microwave polarimeter measuring all 4 Stokes parameters at 8.918 GHz simultaneously at three different highfrequency bandwidths (40 kHz, 400 kHz, and 5 MHz) has been developed in order to observe the linear component and its Faraday rotation. The respective minimum detectable changes of the Stokes parameters I, Q, U, and V are 9, 3, and 1 solar flux unit at an integration time of 1 s. For burst intensities greater than 300 solar flux units, the minimum detectable degree of linear and circular polarization is 1 to 3%, depending on the bandwidth. Observations of 68 bursts showed that most of the bursts were circularly polarized. No linear polarization could be found within the limits of accuracy of the polarimeter. Two possible explanations for this result are discussed. The possibility of mode coupling however cannot be excluded from these first observations. (auth)

**1218** INTERPRETATION OF DISTINCT TYPE IVmA- AND IV-$\mu$-BURSTS ON THE BASIS OF MICRO-INSTABILITIES AND OF RESONANT NONLINEAR INTERACTION OF WAVES. Mollwo, W. (Zentralinstitut fuer Soral-Terrestrische Physik, Berlin). Solar Phys.; 30: No. 2, 497-511(Jun 1973).

The generation of space charge waves by micro instabilities of the Harris type and their conversion into electromagnetic waves is discussed in the framework of the dispersion curves of the extraordinary wave mode in the warm plasma. Acceleration of electrons as also nonlinear interactions of waves are taken into account. A survey of the parameter regions of the Harris instabilities is given. Distinct values $\omega p/\omega c$ and $\omega/\omega c$ result, enabling the instability as well as the conversion. The moving type IVmA bursts, and on the other side the impulsive cm-bursts and the first phase of type IV$\mu$ bursts are correlated to different values $\omega p/\omega c$ and corresponding heights in the corona. The space charge waves can produce hydromagnetic waves by parametric excitation, too (type II bursts). The proposed mechanism is discussed with respect to the energy balance and to the magnetic configurations derived from observations with the Culgoora radioheliograph. (auth)

**1219** THEORY OF THE ORIGIN OF THE SPLIT PAIR BURST EMISSION FROM THE SOLAR CORONA. Yip, W. K. (Univ. of Otago, Dunedin, New Zealand). Solar Phys.; 30: No. 2, 513-526(Jun 1973).

The radio emissions caused by electron streams in a nonisothermal plasma are studied quantitatively. It is proposed that conversion of the stream-excited plasma waves into electromagnetic waves by scattering on the thermal fluctuations at nonisothermal sonic oscillation frequency is the origin of the emission of the split-pair burst near the plasma frequency. The occurrence of the split-pair burst near the second harmonic of the plasma frequency can be due to combination scattering of the stream-excited plasma waves by electron density fluctuations which are produced by the scattered plasma waves. With a streamer model in which the electron densities are two times those in Newkirk's model, both the observed frequency splitting and the rate of drift of the split pair can be explained as the result of plasma radiation caused by a stream of 10 keV electrons. A tentative model for the split-pair emission is suggested. (auth)

**1220** LATITUDINAL MOTION OF SUNSPOTS AND SOLAR MERIDIONAL CIRCULATIONS. Ward, F. (Air Force Cambridge Research Labs., Bedford, MA). Solar Phys.; 30: No. 2, 527-537 (Jun 1973).

A fundamental distinction can be made between those theories of the solar general circulation which require a mean north-south circulation in the photosphere and those which do not. Regardless of the theoretical merits of either group, they must either explain the data, or a theoretical set of data which falls within the observed limits. A detailed analysis of the Greenwich sunspot data supports a mean meridional circulation in either direction with a velocity less than one meter per second. The sunspot data therefore cannot be used to establish the existence of a mean north-south circulation, but may be used as an argument against any theoretical requirement for such a circulation much in excess of 1 m $s^{-1}$. (auth)

**1221** REVISION OF THE PROBABILITY LAWS OF SUNSPOT VARIATIONS. Gleissberg, W. (Univ., Frankfurt am Main). Solar Phys.; 30: No. 2, 539-542(Jun 1973).

Of the four probability laws of sunspot variations established in 1942 only those concerning the four-cycle averages of the reduced period of rise and of the height of maximum are confirmed by the addition of recent data. Improved formulations of these two laws are given. (auth)

**1222** PROSPECTS FOR COMET KOHOUTEK (1973f). Lyttleton, R. A. (Cambridge Univ., Eng.). Nature (London); 245: No. 5422, 200-201(28 Sep 1973).

An assessment is made of the status of this newly discovered comet, which is speeding towards perihelion passage at about the end of the year and which may prove to be the most spectacular comet of the century. It is thought that present estimates of its eventual maximum brightness may be optimistic. On the basis of the "icy nucleus" model activity in the form of tail production and interaction with the solar wind should be well under way early in December 1973; but on the basis of the widely spaced dust particle swarm model for the structure of comets more precise prediction can be made for the time of onset of strong tail production, and this prediction is substantially different from that suggested by the former model, and may provide a crucial test between the two models. It is pointed out that the comet will be very awkwardly situated when near perihelion for observation from Earth because of the proximity of the Sun to the line of sight. Observation of the tail shortly after perihelion should, however, become possible from Earth, and the geometrical conditions continue suitable as the comet recedes from the Sun. The applicability for space vehicles for observational purposes is discussed. With regard to emission spectra the comet should certainly exhibit the presence of volatile radicals, and even elements such as Na, Mg, Ni, and possibly Fe. The shape and size of the comet are also discussed. (UK)

**1223** DEVELOPMENT OF AN $H_2O$ ATMOSPHERE AROUND COMET KOHOUTEK (1973f) AND ITS POSSIBLE DETECTION. Ip, W. H.; Mendis, D. A. (Univ. of California, San Diego, La Jolla). Nature (London); 245: No. 5422, 197-199(28 Sep 1973).

It is thought that the newly discovered great comet Kohoutek may provide an excellent opportunity for directly observing a "parent molecule" ($H_2O$) for the first time. In this communication consideration is given to the continuous development of an $H_2O$ atmosphere around the nucleus as the comet approaches the Sun and to the possibility of its detection. The density and velocity profiles for an ($H_2O$, OH, H, O) atmosphere at various heliocentric distances were computed and the rates of production of $H_2O$ calculated. Methods for possible detection are indicated. (UK)

**1224** BODE'S LAW AND THE RESONANT STRUCTURE OF THE SOLAR SYSTEM. Dermott, S. F. (Newcastle-upon-Tyne Univ., Eng.). Nature (London) Phys. Sci.; 244: No. 132, 18-21(9 Jul 1973).

In this discussion of Bode's law of planetary and satellite distances the author considers whether the law could have arisen by chance, and how the near resonances between a number of orbits in the solar system may have developed. (auth)

**1225** CANYON DIABLO METEORITE. Vdovykin, G. P. (Inst. of Geochemistry and Analytical Chemistry, Moscow). Space Sci. Rev.; 14: No. 6, 758-831(Jul 1973).

The giant diamond-containing Canyon Diablo meteorite is in composition a typical representative of the widespread group of iron meteorites—the coarse octahedrites. But it is unique in a number of scientifically important aspects. When it fell, it formed the Arizona (Barringer meteorite crater (1220 m in diam)), which is of the explosive type. The investigations of the shock recrystallization of the crater rocks and the meteoritic material are of importance for planetology, and in particular for the eludication of matter recrystallization conditions during the collisions of large cosmic bodies. The Canyon Diablo meteorite fell in Arizona, U. S. A., some tens of thousands years ago. Signs of shock recrystallization of the rocks—shatter cones, impactites, dense and super-dense silica modifications were revealed in the Arizona meteorite crater. The total weight of the material attributed to the meteorite is put at 30 tons. Typical samples of the Canyon Diablo meteorite are represented by coarse octahedrite matter with kamacite band widths of 1.8–2.2 mm. In many meteorite fragments, especially fragments found on the crater rim, the Widmanstätten pattern has been destroyed as a result of the explosion which occurred when the meteorite hit the Earth. The meteorite is rich in accessory minerals (cohenite, schreibersite, troilite). The Ni content is, in typical samples of the meteorite, about 7.16%, in rare, atypical, medium octahedrite samples the Ni content reached 8.2%. In the content of trace elements the meteorite may be classified with the I Ga–Ge group. In the content of stable isotopes of elements there is no substantial difference between the Canyon Diablo meteorite and other octahedrites. Radioactive cosmogenic isotopes are represented by isotopes with a large half-life. The diamonds in the Canyon Diablo meteorite are unevenly distributed and are found inside the highly recrystallized meteorite fragments at the rim of the crater. Diamonds are present in the form of intergrowths of microcrystals, crystallite sizes are $<1\mu$, the sizes of the intergrowths reach 2–5 mm. Admixtures of graphite and the hexagonal diamond lonsdaleite are present in the intergrowths. 171 references. (auth)

**1226** MIGHEI METEORITE. Vdovykin, G. P. (Inst. of Geochemistry and Analytical Chemistry, Moscow). Space Sci. Rev.; 14: No. 6, 832-879(Jul 1973).

The Mighei meteorite is generally considered to be unique amongst the group of stony meteorites known as the carbonaceous chondrites in a number of scientifically interesting aspects. The meteorite, which is related to the type II carbonaceous chondrites of Wiik's classification (or type C2 according to van Schmus and Wood), contains extraterrestrial organic compounds (general C content = 2.6%), and extraterrestrial water associated with iron-magnesium silicate crystals (general $H_2O$ content = 12%). The meteorite fall occurred in 1889, over a region in the Ukraine. In structure it was found to be a chondritic meteorite, having chondrules of order 0.5 mm in size. The composition of the meteorite is inhomogeneous. In mineralogical terms the meteorite is composed of two paragenetic associations, described as "high" and "low temperature", which are generally distributed in equal proportions. The "low temperature" associations are a characteristic only of carbonaceous chondrites: the minerals involved are chlorites or the serpentine group, carbonates, free sulphur, sulphates and "low temperature" glass. In chemical terms the Mighei meteorite is somewhat enriched in the volatile elements S, C, H, N, O in comparison to the usual chondrites. These elements are found in different forms and the isotopic composition of the elements S, C, O, is different for different phases. The meteorite is also rich in a number of other fairly volatile element admixtures such as: B, F, Cl, Cu, Zn, Ga, Ge, Br, In, Te, I, Hg, Tl, Pb, Bi, and contains somewhat enhanced initial quantities of rare gases. The organic compounds are of an abiological nature in the meteorite and are located in finely dispersed distributions between the chondrules. They are present in the main, as polymerized organic compounds. Among these polymers there are gaseous hydrocarbons (saturated and nonsaturated) and extractable organic compounds. In the latter condition the following organic compounds have been identified: aliphatic hydrocarbons, aromatic hydrocarbons, amino acids and others. The meteorite contains free organic radicals ($10^{17}$ centres $g^{-1}$), uncoupled $\pi$-electrons which are delocalized in the aromatic structure of the polymeric matter. The radiogenic age of the meteorite has been determined as from 2.4 to $3.2 \times 10^9$ yr (by the K–Ar method) and up to $4.54 \times 10^9$ yr (by the Rb–Sr method), while the radiation age is put at 0.5 to $2.4 \times 10^6$ yr. Details of the meteorite structure give evidence of at least two processes in its formation; the accretion of the meteoritic matter, together with the simultaneous formation of organic compounds could have taken place at temperatures between 450 and 300°K. 161 references. (auth)

**1227** MAGNETIC FIELD OF THE SUN. Marik, M. (Eotvos Lorand Univ., Budapest). Magy. Fiz. Foly.; 21: No. 3, 179-189 (1973). (In Hungarian).

The magnetic field of the Sun was examined from the viewpoint of the astronomer, with consideration of the magnetohydrodynamic equations. It was found that, because of their large conductivity and large dimensions, the damping of astronomical plasmas may be neglected and that these systems may be treated as ideal plasmas. The characteristic behavior of sunspot cycles and chromospheric flares is described, pointing out that there is no theory to explain the generation of flares which involves the transformation of magnetic energy into radiative energy. The Babcock theory of sunspots is also critically examined. (TTT)

**1228** CHONDRITES: INITIAL STRONTIUM-87/STRONTIUM-86 RATIOS AND THE EARLY HISTORY OF THE SOLAR SYSTEM. Wetherill, G. W.; Mark, R.; Lee-Hu, C. (Univ. of California, Los Angeles). Science; 182: No. 4109, 281-283(19 Oct 1973).

A sodium-poor, calcium-rich inclusion in the carbonaceous chondrite Allende had a $^{87}Sr/^{86}Sr$ ratio at the time of its formation of 0.69880, as low a value as that found in any other meteorite. The higher $^{87}Sr/^{86}Sr$ ratios found in ordinary chondrites indicate that their formation or isotopic equilibration occurred tens of millions of years later. (auth)

**1229** SOLAR SURGES: MAGNETIC PROPERTIES, DYNAMICS, AND STRUCTURE. Roy, J. R. London, Ont.; Univ. of Western Ontario (1973). National Library of Canada, Ottawa.

Thesis (Ph. D.).

This investigation was an attempt to determine the conditions under which sporadic mass ejections, called solar surges, occur in sunspot regions of the solar atmosphere. High resolution (~0.3 arcsec) on- and off-band Hα filtergrams (passband of ¼ Å) of disk solar surges obtained with the Vacuum Tower Telescope of Sacramento Peak Observatory were compared to magnetic data. (WDM)

1230 MONTE CARLO TREATMENT OF LYMAN α RADIATION. Modali, S. B. Austin, TX; Univ. of Texas (1972). 139p. University Microfilms Order No. 73-18,472.

Thesis (Ph. D.).

A Monte Carlo technique involving Stokes vectors is used to obtain the state of polarization and intensity of solar Lyman-α photons as they diffuse through a plane parallel homogeneous model of the earth's hydrogen envelope. Previous calculations of Lyman-α radiation transfer, using classical techniques of solving the radiative transfer equation, were not able to say much about the state of polarization. They also did not consider the fine structure of Lyman-α, which was incorporated. (WDM)

1231 PRECISE MEASUREMENT OF THE SUN'S VISUAL OBLATENESS. Clayton, P. D. Tucson, AZ; Univ. of Arizona (1973). 145p. University Microfilms Order No. 73-20,644.

Thesis (Ph. D.).

The question of solar oblateness is important in relationship to the experimental verification of gravitational theories. The observed perihelion precession of Mercury is presently the only test of sufficient accuracy to verify Einstein's General Theory of Relativity. The agreement between theory and observation in this instance implicitly assumes that the Sun does not have a gravitational quadrupole moment. If there is no visual solar oblateness, it is difficult to conceive that a gravitational quadrupole could exist. On the other hand a visual oblateness would not indicate unequivocally that a quadrupole moment exists; one must still ascertain that the visual edge definition was not influenced by latitude dependent variations in the solar limb intensity profile and gain additional understanding about the relationship between the solar photosphere and the gravitational equipotential surface. Previous reliable observations consist of an impressive eleven year undertaking by Schur and Ambronn in which visual observations using a heliometer indicated a small oblateness consistent with the rotation of the Sun, and a modern measurement in which Dicke and Goldenberg used electronic techniques to obtain a visual oblateness of $(\Delta R/R) \sim 5 \times 10^{-5}$. A gravitational quadrupole moment as large as the visual result of Dicke and Goldenberg would be of significance in gravitational theory. The present oblateness measurement was made using the astrometric telescope at SCLERA (Santa Catalina Laboratory for Experimental Relativity by Astrometry) about 40 miles northeast of Tucson, Arizona. This telescope was designed to minimize optical aberrations and allow quantitative analysis of any residual errors. (WDM)

1232 ANNUAL AND QUARTERLY VARIATIONS OF SOLAR ACTIVITY AND COSMIC-RAY INTENSITY. Kolomeyets, Ye. V.; Shakhova, Yu. A. (Kazakh State Univ., USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 187-190(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 219-222(1973).

Annual and quarterly variations of solar activity and cosmic-ray intensity were studied during the period 1958-68. It is shown that a stable annual wave with an amplitude of 10 to 40% takes place in the intensity of the 5303 Å coronal line, and that the amplitude of the annual wave amounts to 0.5 to 2% in cosmic-ray intensity. The main contribution to the annual variation of the neutron component is made by the change in solar activity. Also discussed is the relation of changes in cosmic-ray intensity and solar activity to the periods of rotation of Mercury and Earth. (auth)

1233 CALCULATIONS OF THE ION FORMATION FUNCTION FOR THE AVERAGE SOLAR ACTIVITY. Akatova, L. A.; Velichanskii, B. N.; Ivanov-Kholodnii, G. S.; Ivel'skaya, M. K.; Klimov, N. N. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 214-219(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 249-255(1973).

Results of a calculation of the rate of formation of ions in the upper atmosphere by shortwave solar radiation are presented for the three main gaseous components of the atmosphere. Jacchi's 1971 model of the upper atmosphere was used. New data on the spectrum and intensity of solar radiation and on absorption cross sections and photoionization in 150 spectral intervals were taken. The effect of ionization by photoelectrons and secondary electrons was considered. Calculations of the rate of ion formation were made for exospheric temperatures of 600 to 1300°K and heights of 90 to 1000 km for 0 to 95° zenith angles of the Sun. The effect of afternoon asymmetry was analyzed. (auth)

1234 EIGENVALUE PROBLEM IN THE QUESTION OF DIFFUSION AND GENERATION OF MAGNETIC FIELDS IN A SPHERE. Noskov, N. N. (Siberian Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Irkutsk, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 298-304(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 347-354(1973).

The problem of eigenfunctions of an equation for the large-scale component of a magnetic field with boundary conditions for a solar type configuration is solved. The damping increment of the first harmonic is calculated. The problem of eigenfunctions of an equation for the large-scale component of the magnetic field in gyrotropic turbulence with boundary conditions for a star type configuration is solved. The threshold value of the wave vector, the harmonic with the maximum rate of increase, and the critical radius of the star are obtained. (auth)

1235 INTERACTION OF THE EARTH'S MAGNETIC FIELD WITH THE ANTIPARALLEL FIELD OF THE SOLAR WIND. Kovner, M. S. (Gorky State Univ., USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 258-261(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 302-305(1973).

The dissipation of the magnetic field in the magnetopause is investigated. Low-frequency oscillations of the magnetospheric boundary and the electric field arising from the motion of the magnetopause are discussed. (auth)

1236 POSSIBLE NATURE OF THE FINE STRUCTURE OF SPORADIC RADIO EMISSION FROM THE SUN AND OTHER SPACE OBJECTS WITH HIGH-DENSITY ELECTROMAGNETIC RADIATION. Dorman, L. I.; Kats, M. Ye.; Yukhimuk, A. K. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 171-176(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 201-207(1973).

One of the possible mechanisms of formation of the fine structure of sporadic solar radio emission and radio pulses of pulsars is discussed. The processes occurring in a plasma in the presence of strong electromagnetic radiation are analyzed. The correlation functions of various physical quantities characterizing the state of magnetoactive plasma in the presence of strong electromagnetic radiation were found. Coefficients of scattering of electromagnetic waves by electron density fluctuations were calculated. It is shown that the presence of fine structure of sporadic solar radio emission and pulsars may be related to scintillations caused by fluctuations of plasma electron density. (auth)

1237 EVALUATION OF DETECTION PROBABILITY AT THE EARTH'S ORBIT OF PROTON FLUXES OF SOLAR COSMIC RAYS. Getselev, I. V.; Tkachenko, V. I. Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 177-180(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 208-211(1973).

A method is proposed for calculating the observation probabilities of solar cosmic ray fluxes, based on the assumption that the times of appearance of proton flares are described by Poisson's law. Tables and graphs are given which permit the determination of the energy spectra of solar protons and probabilities of their observation as a function of the flight time of the spacecraft. (auth)

1238 ALFVÉN WAVES IN A TWO-FLUID MODEL OF THE SOLAR WIND. Hollweg, J.V. (Department of Physics, California Institute of Technology). Astrophys. J. 181: No. 2, 547-566 (15 Apr 1973).

We present a two-fluid model for the solar wind which includes the presence of Alfvén waves which originate at the Sun. The effective pressure of the Alfvén waves is included, as well as a model representation for proton heating via nonlinear damping of the Alfvén waves. The effects of rotation in the solar equatorial plane are self-consistently included. Our principal results are summarized as follows: 1) Our calculations reproduce the $T_p$–v correlation at 1 a.u. quite well for $v \lesssim 450$ km s$^{-1}$. This supports the idea that Alfvén waves of solar origin are responsible for the high-speed streams. 2) An Alfvénic energy flux of 6000 ergs cm$^{-2}$ s$^{-1}$ at the Sun yields values for $T_p$, v, and n at 1 a.u. which agree well with the data. 3) Wave pressure tends to produce a positive n–v correlation at 1 a.u., contrary to the observed negative correlation. This suggests that the cross-section of the high-speed streams may increase more rapidly than $r^2$. 4) Including the spiral magnetic field in the electron energy equation worsens the disagreement between observed and calculated values of $T_e$ at 1 a.u., if the electron heat conductivity is given by the collisional value. More work on the electron energy equation is needed. 5) Peripheral to our main theme, we present (a) general derivation of the conservation equations in the presence of Alfvén waves; (b) a simple, new derivation for the properties of Alfvén waves in a spiral field; and (c) a new power series for the electron temperature near $r = \infty$, in the presence of a spiral magnetic field. (auth)

1239 DISSIPATION OF HYDROMAGNETIC WAVES WITH APPLICATION TO THE OUTER SOLAR CORONA. III.

TRANSITION FROM COLLISIONAL TO COLLISIONLESS PROTONS. Hung, R.J.; Barnes, A. (Space Science Division, Ames Research Center, NASA, Moffett Field, California). Astrophys. J. 181: No. 1, 183-208 (1 Apr 1973).

We develop the theory of hydromagnetic wave dissipation in a region of transition between collisional and collisionless proton behavior. Dissipation by proton–proton collisions and electron thermal conduction on the collisional side of the transition passes continuously into proton Landau damping on the collisionless side of the transition. For waves of period 5 min in the solar corona, this transition occurs within 2 $R_{\odot}$ heliocentric distance. (auth)

1240 RESISTIVE DIFFUSION OF FORCE–FREE MAGNETIC FIELDS IN A PASSIVE MEDIUM. Low, B.C. (Department of Physics, University of Chicago). Astrophys. J. 181: No. 1, 209-226 (1 Apr 1973).

A force–free magnetic field B(x,t) satisfying $\nabla\times B=\alpha B$ for nonconstant $\alpha$ will change its shape as it undergoes resistive diffusion. We consider the resistive diffusion of such a force–free magnetic field in a tenuous compressible medium, which is free to move to accommodate the changing magnetic–field configuration. This process is nonlinear, contrary to the usual magnetic field diffusion in a fixed medium. We show that the force–free magnetic field may evolve slowly for an extended period of time, whereupon it abruptly develops steep gradients and passes into an explosive phase. We suggest that is is this process that sets the stage for the onset of solar flares. (auth)

1241 ON STEADY MAGNETIC–FIELD RECONNECTION. Priest, E.R. (High Altitude Observatory, National Center for Atmospheric Research, Boulder, Colorado). Astrophys. J. 181: No. 1, 227-235 (1 Apr 1973).

Magnetic–field reconnection may be essential in a variety of solar and astrophysical phenomena, and there has been much debate as to the maximum allowable rate of reconnection. Petschek's mechanism, for instance, permits a maximum rate of about one–tenth of the Alfvén speed, $u_A$, but is probably unworkable. Yeh and Axford, on the other hand, have recently claimed that any rate is possible up to $u_A$. A more careful matching of the internal and external regions in Yeh and Axford's mechanism is here performed, with the conclusion that the highest rate of reconnection is about $u_A/18$. (auth)

1242 THERMAL PLASMA FLUCTUATIONS AND THE BOUND-STATE $^7$Be$(e^-,\nu)^7$ Li RATE IN THE SUN. Watson, W.D.; Salpeter, E.E. (Laboratory for Atomic and Solid State Physics, and Center for Radiophysics and Space Research, Cornell University). Astrophys. J. 181: No. 1, 237-240 (1 Apr 1973).

The influence of thermal fluctuations in the screening on the capture rate of bound, K–shell electrons by $^7$Be is investigated for conditions in the Sun where most of the predicted neutrino flux in the Davis experiment is produced. This capture rate is decreased by about 7 percent, and the predicted solar neutrino flux is thus increased by a few percent—a negligible change for comparisons between theory and observation. A two–parameter variational wave–function and a Monte Carlo technique are employed in the calculations. (auth)

1243 NONLINEAR MODEL OF HIGH–SPEED SOLAR WIND STREAM. Hundhausen, A.J. (High Altitude Observatory, National Center for Atmospheric Research, Boulder, Colorado, 80302). J. Geophys. Res. 78: No. 10, 1528-1542 (1 Apr 1973).

A hydrodynamic model describing the generation and propagation of high–speed plasma streams in the solar wind is presented. The model is based upon numerical integrations of the conservation equations for a time–dependent, spherically symmetric, radial flow of interplanetary plasma. The nearly radial nature of the solar wind flow justifies the use of the model to approximate 'corotating streams,' e.g., nonspherically symmetric flows that are steady in a frame of reference rotating with the sun. The predicted variations in solar wind properties are in good agreement with those observed at 1 AU for a reasonable choice of parameters characterizing a 'coronal disturbance' at the heliocentric distance of 28 Rs. This choice must include a perturbation of the coronal temperature but need not include perturbations of the coronal density or mass efflux. The streams produced by such a disturbance 'steepen' in transit to the orbit of the earth, with formation of a pair of shocks predicted at slightly larger heliocentric distances. The average dependencies of density and temperature upon the solar wind speed deduced from the model resemble those inferred from solar wind observations. This suggests that the major density changes associated with high–speed streams are the products of interplanetary compression and rarefaction within the evolving stream structure. The same processes explain the deviations of proton temperature from their average dependence on solar wind speed; however, that basic dependence appears to reflect the temperature changes imposed on the plasma in the corona. (auth)

1244 POWER SPECTRUM OF DENSITY IRREGULARITIES IN THE SOLAR WIND PLASMA. Rickett, B.J. (University of California at San Diego, La Jolla, California, 92037). J. Geophys. Res. 78: No. 10, 1543-1552 (1 Apr 1973).

Observations of interplanetary scintillations are compared with predictions based on a spatial electron density spectrum extrapolated for the power law shape at wave numbers $10^{-6}$–$10^{-5}$ rad/km measured from spacecraft. The influences of the power law exponent, a high wave number cutoff, and the Fresnel filter are examined with respect to scintillation index and pattern scale. The comparison suggests a model in which the high wave number density spectrum lies below the extrapolated power law but has a relatively flat part before the cutoff. (auth)

1245 NEW OBSERVATIONS OF THE SOLAR ULTRAVIOLET CHROMOSPHERE. Bruner, E.C. Jr.; Parker, R.W.; Chipman, E.; Stevens, R. (Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder). Astrophys. J. Lett. 182: No. 1, L33-L34 (15 May 1973).

We present some of the results of a rocket flight which obtained a stigmatic spectrum of the sun in the region 1190 to 1320Å. The experiment achieved a spectral resolution of 0.01Å throughout this range, and the effective angular resolution was about 20″. Lines which are formed in the chromosphere and transition zone show strong fluctuations with position on the disk. The correspondence between the H L$\alpha$ profile and chromospheric details seen in the Ca K–line is demonstrated. (auth)

1246 THE EXTREME–ULTRAVIOLET SPECTRUM OF A SOLAR ACTIVE REGION. Dupree, A.K.; Huber, M.C.E.; Noyes, R.W.; Parkinson, W.H.; Reeves, E.M.; Withbroe, G.L. (Harvard College Observatory). Astrophys. J. 182: No. 1, 321-333 (15 May 1973).

Extreme–ultraviolet spectra (280–1370 Å) of the brightest point in McMath Region 10266 and of the quiet solar atmosphere are presented as measured by the Harvard scanning spectrometer on OSO–6. Line identifications and physical parameters of the active region are discussed. (auth)

1247 INFLUENCE OF THE VELOCITY DISPERSION OF INTERPLANETARY IRREGULARITIES ON THE TIME SPECTRA OF RADIO–SOURCE SCINTILLATIONS. Shishov, V.I. (Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. Astron.–AJ 16: No. 6, 1008-1012 (May 1973).

The scintillation time spectra of radio sources located close to the sun ($\epsilon<10^{\circ}$) are considered. The relation found by Cohen and Gundermann for the scintillation index m of the sources CTA 21 and 3C 279 as a function of the distance $\epsilon$ from the sun in the region of saturated fluctuations $\epsilon<\epsilon_0$ (where m decreases with $\epsilon$) can be explained only by taking into account both the finite source size and the finite receiver passband. The $\epsilon$ dependence of the second moment $f_2$ in the saturation region implies that the irregularities in the interplanetary plasma have a velocity dispersion comparable to their mean velocity: $\Delta u/u\simeq0.3$–0.5. (auth)

1248 COMPUTATION OF SELF–CONSISTENT MODELS FOR THE SOLAR AND STELLAR CHROMOSPHERES. Kaplan, S.A.; Ostrovskii, L.A.; Petrukhin, N.S.; Fridman, V.E. (Gor'kii Radiophysics Research Institute). Sov. Astron.–AJ 16: No. 6, 1013-1018 (May 1973).

A method for the self–consistent solution of the problem of sound–wave propagation in an inhomogeneous medium, the formation of shocks, and energy dissipation in these shocks is given. The method takes into account the manner in which the temperature variations react on the conditions of the wave propagation. A system of ordinary differential equations is set up which can easily be solved with the aid of an electronic computer. Models for the solar chromosphere are computed using this method, and the entire temperature variation–decrease with altitude in the photosphere, the inversion zone, and increase with altitude in the chromosphere—is obtained. The dependence of the temperature distribution on the parameters of the heating waves is considered. The method can be generalized to more complex photospheric–chromospheric models. (auth)

1249 QUASIPERIODIC (WAVELIKE) MOTIONS IN THE SOLAR PHOTOSPHERE. I. PRELIMINARY RESULTS. Mel'nikov, O.A.; Salman–Zade, R.K.; Solonskii, Y.A.; Khilov, E.D. (Leningrad University Observatory). Sov. Astron.–AJ 16: No. 6, 1019-1022 (May 1973).

Direct spectroscopic measurements have been made of short–period differential line shifts in the photospheric spectrum at the center of the undisturbed solar disk. A period of $\simeq 8$ min has been determined, as compared to the 5–min period derived previously from indirect measurements and the bulges observed along the height of the lines. A comparison of several sets of observations indicates that the phenomenon may be in itself quasiperiodic or cyclic. (auth)

1250 TIME DEPENDENCE OF THE POLARIZATION OF TYPE III SOLAR RADIO BURSTS. Chertok, I.M. (Institute of Terrestrial Magnetism, the Ionosphere, and Radio-Wave Propagation, Academy of Sciences of the USSR). Sov. Astron.–AJ 16: No. 6, 1023-1027 (May 1973).

A previous discussion of the time dependence p(t) of the polarization of type III bursts is generalized to the case where the stream exciting the burst is inhomogeneous. In this event p(t) declines gradually while the burst intensity is still rising, but the polarization is somewhat higher than in the case of a homogeneous flux. The effect on p(t) of the group delay of ordinary and extraordinary waves is also examined. (auth)

## Galaxies

*Refer also to abstracts 1115 and 1195.*

**1251** NEW WORLD OF GALACTOCHEMISTRY. Brown, R. D. (Monash Univ., Clayton, Australia). Chem. Brit.; 9: No. 10, 450-455(Oct 1973).

A review is given of this new and fascinating branch of chemistry, starting with the detection, several years ago, of $NH_3$, $H_2O$, and HCHO in interstellar space. Since then, with the advent of better radiotelescopes, about 20 other small molecules have been identified. Questions discussed include: how many more of these molecules exist, how are they formed, what sort of reactions do they undergo, and were they of any significance in the origin of life. It is certain, however, that under galactic conditions the chemistry of these molecules is very different from that on Earth. (UK)

**1252** BEHAVIOUR OF DUST UNDER THE INFLUENCE OF RADIATION PRESSURE AND GRAVITY. Bondi, H. (Ministry of Defense, London); Noerdlinger, P. D. Mon. Notic. Roy. Astron. Soc.; 163: No. 4, 401-421(1973).

A study was made of the behaviour of dust under the influence of a centrally symmetric source of gravitation and radial light rays according to general relativity. In one approach the motion of the dust is derived by examining a representative test particle scattering the light isotropically in its rest frame (or alternatively absorbing the light or reflecting it back specularly to the source). Consideration is given next to a thin pressure-free spherically symmetric shell of dust and its motion is derived directly from the field equations, confining the study of necessity however to specularly reflecting and absorbing dust. The radial motion is fully analysed and confirmation is found for isotropically scattering and for specularly reflecting dust, for the stabilization effect first found by one of the present authors (Noerdlinger, Nature; 237: 5349 (1972)). The treatment is also extended to test particles with nonzero angular momentum about the source. The comparison of the two methods leads to an analysis clarifying the relation between rest mass and active gravitational mass which latter is shown to be a generalization of what has been considered the Hamiltonian of the material in other contexts. (auth)

**1253** EXCITATION OF INTERSTELLAR HYDROGEN CYANIDE IN THE ORION MOLECULAR CLOUD. Clark, F. O. Charlottesville, VA; Univ. of Virginia (1973). 167p. University Microfilms Order No. 73-24,956.

Thesis (Ph. D.).

A new and potentially powerful method was used to analyze microwave observations of interstellar hydrogen cyanide in the Orion molecular cloud. This method incorporated recent work on collapsing protostellar clouds, detailed excitation calculations, and numerical solution of the equation of radiative transfer. Excellent agreement with observations was achieved. The results of this type of analysis were number density per cubic centimeter of $H_2$ and all observed HCN isotopes. Relative abundances of the molecular isotopes of HCN clearly showed nonterrestrial abundances, if interpreted as reflecting elemental isotopic abundances. The number density per cubic centimeter was somewhat sensitive to the poorly known collisional cross section of interaction, while the molecular isotopic ratios were less so. This type of analysis clearly showed the necessity of including the density gradient and meaningful excitation in spectral line analysis. (Diss. Abstr. Int., B)

**1254** PROPOSED ULTRAVIOLET STUDIES OF INTERSTELLAR POLYATOMIC MOLECULES AND SUPPORTING RADIO OBSERVATIONS. Giguere, P. T. Charlottesville, VA; Univ. of Virginia (1973). 141p. University Microfilms Order No. 73-25,005.

Thesis (Ph. D.).

Areas are explored in which ultraviolet spectroscopy offers advantages for the study of the interstellar medium through observation of polyatomic molecules. A list of O and B stars that are potential candidates for future uv polyatomic molecule searches is given. Seven of these stars were observed in the J = 1-0 line of HCN with the 36-foot radio telescope of the National Radio Astronomy Observatory. Positive radio results were obtained for two stars, Herschel 36 and "Anon 1/NGC 7538". In addition to their intrinsic interest, such radio studies will be of special value when it is possible to correlate them with future uv studies of the same stars. Also, radio molecular observations are of use in choosing those OB stars which should receive extensive scrutiny with future uv satellites, a nontrivial matter in view of the large amounts of integration time that will be required for observation of complex molecules in the uv. From the results obtained, Herschel 36 and Anon 1/NGC 7538 appear to be among those stars. Also, the star Walker 178 was found to be quite near a HCN cloud mapped in NGC 2264. It is expected that the uv observations will be done with the International Ultraviolet Explorer satellite (IUE) in the mid-1970's and later with the Large Space Telescope (LST). Calculations are presented which show that a benzene search should receive a high priority in uv studies of stars such as Herschel 36. A radio search for fulvene, an isomer of benzene, with negative results, is described. The problem of detecting optical rotatory dispersion (ORD) caused by interstellar optically active molecules is considered, with particular emphasis given to the simpler amino acids, especially alanine. While it now appears that such a project will be very difficult, the potential rewards of success are great. (Diss. Abstr. Int., B)

**1255** DISTANCE TO THE GALACTIC CENTER USING LUMINOUS EARLY-TYPE STARS. Harris, B. L. Charlottesville, VA; Univ. of Virginia (1973). 89p. University Microfilms Order No. 73-24,972.

Thesis (Ph. D.).

Using 114 luminous early-type stars which lie in the galactic plane near the radial velocity nodes, $R_0$ resulting from the northern hemisphere stars was 8.3 ± 0.4 kiloparsecs, while the value determined from the southern hemisphere stars was 8.8 ± 0.4 kiloparsecs; there was no evidence of galactic expansion. The means were the result of individual $R_0$ values weighted inversely proportional to their uncertainties squared. Grouping stars somewhat arbitrarily to try to erase the effect of systematic motion resulted in $R_0$ of 6.8 ± 0.7 kpc. These stars, however, do not strongly delineate regions of deviations from circular motion. The southern stars used fall along spiral features; the northern ones do not. In the Cygnus direction, the ratio of total to selective absorption needs more investigation. Details of new radial velocity and distance determinations for 25 northern hemisphere stars are presented. (Diss. Abstr. Int., B)

**1256** GALACTIC WINDS DRIVEN BY COSMIC RAYS. Ipavich, F. M. College Park, MD; Univ. of Maryland (1972). 50p. University Microfilms Order No. 73-18,245.

Thesis (Ph. D.).

Cosmic rays traveling with mean velocity greater than the Alfvén speed can generate magnetohydrodynamic waves, which in turn scatter the cosmic rays and reduce their anisotropy. In the process, the waves are amplified by the cosmic rays and damped by the background medium (thermal gas). Thus the cosmic rays become coupled to the thermal gas, and cosmic rays escaping from a Galaxy tend to drag along thermal gas. As a result, the thermal gas is heated and accelerated, producing what has been called a "galactic wind," although cosmic rays have never been considered the driving force in a galactic wind. In this thesis the types of steady galactic winds to be expected when cosmic rays escape from a galaxy are described. In order to keep the equations manageable, any radiation emitted by the thermal gas is ignored. Although this is not always legitimate, it is shown that this assumption does not alter the basic structure of a cosmic-ray driven galactic wind. A galactic wind can take gas from a galaxy and move it to a region of ~100 kpc surrounding the galaxy. One consequence of this extended region of gas is its ability to decelerate and confine plasmoids emitted from radio galaxies. Another consequence can occur in clusters of galaxies, with a number of galaxies surrounded by winds. Colliding galactic winds then produce x rays via bremsstrahlung radiation. This process may explain the large observed x-ray luminosities emitted from rich clusters of galaxies. (Diss. Abstr. Int., B)

**1257** INTERSTELLAR GRAINS AS SMALL PARTICLES. Duley, W. W. (York Univ., Toronto). Nature (London) Phys. Sci.; 244: No. 134, 57-59(23 Jul 1973).

In studies of interstellar grains it has been customary to assume that the properties of these particles can be described by those of macroscopic systems with the same composition. Grains cannot, however, be considered in many instances to behave simply as sub-volumes of a macroscopic solid, and it is shown that some parameters describing interstellar grains cannot be predicted from the bulk properties of an assumed grain material. The discussion is limited to small ($r \lesssim 10^{-5}$ cm) spherical grains of refractory materials. It has been suggested that lattice vibrational frequencies in an ionic crystal of finite size would differ from those measured in the bulk material. Application of the Mie scattering theory indicates that all optical properties of a small particle may not be predictable from optical constants obtained from the bulk material. Agreement between the shapes of calculated and observed infrared bands, for example, is usually poor and the transmission spectrum has been found to be considerably broader than predicted from calculation of the absorption coefficient using optical constants of bulk MgO. Photon scattering process may be fundamentally different in small particles. Broadening of spectral lines is influenced by the photon spectrum of the lattice, and hence will differ for bulk and microscopic samples of the same material. Changes in the form of the spectrum of atoms or ions in small particles are expected to be most dramatic for systems in which weak coupling exists between the absorber and the lattice, and it is conceivable that the electronic spectrum of some atoms or ions in small particles at low temperatures may be fundamentally different from that of the same species in the bulk material; this would involve a change in the form of the spectrum that would not be predictable from Mie scattering calculations. The extent to which the temperature of interstellar grains reflects small particle characteristics is discussed. (UK)

**1258** SMOOTHED DISTRIBUTION OF INTERSTELLAR ATOMIC HYDROGEN IN THE GALAXY. Miller, A. C. Charlottesville, VA; Univ. of Virginia (1973). 94p. University Microfilms Order No. 73-25,002.

Thesis (Ph. D.).

A broad beam survey of the 21-centimeter radiation from the interstellar atomic hydrogen in the Galaxy was made towards eight positions 30 degrees apart along the NGP anti-center great circle where the effects of differential galactic rotation are a minimum. At each position the radio telescope, which had a twenty-seven degree beam pyramidal horn antenna, a five-channel load-switched Dicke receiver and a negative-resistance type parametric amplifier for the first stage, integrated approximately 600 square degrees ($^1/_{70}$ of the whole sky) and 16.9 kilometers per second in velocity per channel. A total of thirty-one spectra were taken on eleven days between June 19, and July 26, 1970. The final average spectrum at each position covered ±300 kilometers per second in velocity and had a typical calculated RMS scatter of 0.1 Kelvin in antenna temperature. The smoothed distribution of HI gas shows the general characteristics observed in earlier narrow beam surveys; that is, the thin flat distribution closely aligned with the galactic plane, the presence of the Gould's Belt gas near the Sun and the local deficiency of gas at high positive latitudes. (WDM)

**1259** ADRIAAN VAN MAANEN'S INFLUENCE ON THE ISLAND UNIVERSE THEORY. Hart, R. C. Boston; Boston Univ. (1973). 275p. University Microfilms Order No. 73-23,487.

Thesis (Ph. D.).

The development of A. van Maanen's research on internal proper motions in spiral nebulae and its effects on astronomical research during the period 1916–1935 is traced. This study is based upon an examination of the unpublished archival sources (letters, manuscripts, etc.) which, together with the published materials provide a detailed view of the events surrounding the "island universe" controversy and the influence exerted by van Maanen's results. (WDM)

**1260** DYNAMICS OF ROTATING STELLAR SYSTEMS: COLLAPSE AND VIOLENT RELAXATION. Gott, R. R. III Princeton, NJ; Princeton Univ. (1972). 66p. University Microfilms Order No. 73-18,761.

Thesis (Ph. D.).

A method for following the dynamics of axisymmetric stellar systems is developed and applied to the problem of collapse and violent relaxation in rotating stellar systems. Utilization of an axisymmetric gravitational potential allows treatment of many more stars than would be feasible with a simple N-body calculation. Systems having differing amounts of initial angular momentum and containing 2000 stars each are allowed to collapse under their own gravitational attraction. Collapse and violent relaxation are found to lead to the formation of equilibrium structures after only a few free fall times. The systems contain a sufficient number of stars so as to be effectively collisionless and the equilibrium structures are consistent with accurate satisfaction of the stationary collisionless Boltzmann equation. Rotating equilibrium models produced in this way resemble elliptical galaxies, with elliptical isophotes. With cosmologically reasonable amounts of initial angular momentum, E0 to E4.5 galaxies can be produced. Production of flatter systems such as spiral galaxies would require some form of gaseous dissipation during the collapse. Axisymmetric galaxies having $|T_\gamma/W| \gtrsim 0.23$ are found to exhibit slight ring-like structures. This is consistent with the work of Ostriker and Peebles which indicates that bar instability sets in for systems with $|T_\gamma/W| \gtrsim 0.14$. Energy histograms for the equilibrium galaxies show a characteristic core and halo structure. The more drastic the collapse and subsequent re-expansion, the more prominent the halo that is produced. Thus, rotating systems with their larger initial virial coefficients are observed to produce smaller halo populations than a comparable nonrotating, spherical system. The equilibrium models show rotation curves in general agreement with that expected from violent relaxation theory. All models show a central region with solid-body rotation. Further out, the systems become differentially rotating and far from the center ($V_\phi$) is roughly proportional to $r^{-1}$. Velocity dispersions are the greatest in the central regions, falling off slowly with larger radius. Isotropy of random velocities in the central regions is achieved best in the nonrotating, spherical model. The more rapidly rotating models show less isotropy, particularly in the equatorial plane where the dispersion perpendicular to the plane is the largest component. (Diss. Abstr. Int., B)

**1261** ELECTROGRAPHIC UBV PHOTOMETRY OF THE JET IN M87. Ables, H.D.; Kron, G.E. (U.S. Naval Observatory, Flagstaff Station). Astrophys. J. 181: No. 1, 19-25 (1 Apr 1973).

UBV magnitudes of the jet in M87 have been measured from electronic camera exposures obtained with the 40-inch Ritchey–Chrétien telescope. The observed magnitude and color indices are V=15.73, B−V=0.06, and U−B=−0.44. These color indices are not consistent with a single synchrotron spectrum. (auth)

## Cosmology

*Refer also to abstract 1184.*

**1262** INFLUENCE OF f GRAVITY ON GRAVITATIONAL COLLAPSE. Isham, C. J.; Salam, A.; Strathdee, J. (Im rial Coll. of Science and Tech., London). Nature (London) P . Sci.; 244: No. 136, 82-84(6 Aug 1973).

It is stated that in Trautman's model of a universe with $10^{80}$ aligned neutrons, collapse is averted if the effects of Cartan's torsion are taken into account. The effect of taking f gravity into account is investigated and it is shown that spin-aligned hadronic matter will not collapse to densities higher than $10^{17}$ g cm$^{-3}$. Perfect spin alignment necessary for this result remains a problem here as in Trautman's original work. (auth)

**1263** HUBBLE'S CONSTANT AND ROTATIONAL DECELERATION. Weinstein, D. H. (Superior Oil Co., Houston, TX); Keeney, J. Lett. Nuovo Cim.; 8: No. 5, 299-302(29 Sep 1973).

It is noted that the astronomical evaluation of the Hubble constant has tended to decrease, the latest value being about $1.6 \times 10^{-18}$/s. Fossil evidence on the Earth–Moon–Sun system is presented which may provide a lower bound on that constant. (WDM)

**1264** PRIMORDIAL 2.7° RADIATION AS EVIDENCE AGAINST SECULAR VARIATION OF PLANCK'S CONSTANT. Noerdlinger, P. D. (Michigan State Univ., East Lansing). Phys. Rev. Lett.; 30: No. 16, 761-762(16 Apr 1973).

The blackbody form of the 2.7° cosmic microwave radiation appears to be inconsistent with variation of Planck's constant by as much as 10% since the epoch $z \sim 1000$. (auth)

**1265** CONSERVED QUANTITIES AND THE FORMATION OF BLACK HOLES IN THE BRANS–DICKE THEORY OF GRAVITATION. Dykla, J. J. Pasadena, CA; California Inst. of Tech. (1973). 84p. University Microfilms Order No. 73-18,372.

Thesis (Ph. D.).

A symmetric stress–energy–momentum pseudo-tensor is constructed for the gravitational fields of Brans–Dicke theory, and this is used to establish rigorously conserved integral expressions for energy–momentum $P^i$ and angular momentum $J^{ik}$. Application of the two-dimensional surface integrals to the exact static spherical vacuum solution of Brans leads to an identification of the conserved mass with the active gravitational mass. Application to the distant fields of an arbitrary stationary source reveals that $P^i$ and $J^{ik}$ have the same physical interpretation as in general relativity. For gravitational waves whose wavelength is small on the scale of the background radius of curvature, averaging over several wavelengths in the Brill–Hartle–Isaacson manner produces a stress–energy–momentum tensor for gravitational radiation which may be used to calculate the changes in $P^i$ and $J^{ik}$ of their source. Strong evidence is developed in favor of a conjecture by Penrose—that, in the Brans–Dicke theory, relativistic gravitational collapse in three dimensions produce black holes identical to those of general relativity. After pointing out that any black hole solution of general relativity also satisfies Brans–Dicke theory, the Schwarzschild and Kerr geometries are established as the only possible spherical and axially symmetric black hole exteriors, respectively. Also, it is shown that a Schwarzschild geometry is necessarily formed in the collapse of an uncharged sphere. Appendices discuss relationships among relativistic gravity theories and an example of a theory in which black holes do not exist. (Diss. Abstr. Int., B)

1266 WAVES IN A COLD TRANSCENDENT PLASMA. Lehmann, H. R.; Treumann, R. (Central Inst. of Solar Terrestrial Physics, Berlin). Phys. Lett.; 45A: No. 3, 215-216(24 Sep 1973).

Dispersion relations of longitudinal and transverse modes propagating parallel to an ambient magnetic field in a cold "transcendent" plasma ($\nu > c$) are derived. Some features of longitudinal wave propagation are discussed. (auth)

1267 SEARCH FOR SMALL-SCALE ANISOTROPY IN THE 2.7° K COSMIC BACKGROUND RADIATION AT A WAVELENGTH OF 3.56 CENTIMETERS. Carpenter, R.L. (California State University, Los Angeles); Gulkis, S.; Sato, T. Astrophys. J. Lett. 182: No. 2, L61-L64 (1 June 1973).

Drift scans were made of a selected track on the sky to search for small-scale anisotropy in the microwave background radiation. The observations were made with the 64-m antenna at Goldstone, California, operating at 3.56 cm. The half-power beam width was 2′.3. The scans were approximately 1° in length. The upper bound on the small anisotropy along our track is $\Delta T/T < 7.15 \times 10^{-4}$ (90 percent confidence). Some implications of this result are discussed. (auth)

1268 THE VIRIAL THEOREM IN GENERAL RELATIVITY. Bonazzola, S. (Groupe d'Astrophysique Relativiste, Département d'Astrophysique Fondamentale, Observatoire de Meudon-92, France). Astrophys. J. 182: No. 1, 335-340 (15 May 1973).

The formulation of the virial theorem in general relativity is given for spherical and stationary axisymmetric spacetimes. The Newtonian virial theorem is found in the first approximation. In the nonstationary case, the Newtonian virial theorem is modified by adding a gravitational pressure term. (auth)

## Planetary Phenomena

1269 FINE STRUCTURE OF JUPITER'S DECAMETRIC SOURCE B. Leacock, R. L.; Smith, A. G. (Univ. of Florida, Gainesville). Nature (London) Phys. Sci.; 244: No. 134, 60-61 (23 Jul 1973).

It is stated that Jupiter's decametric radio emission shows two strong periodicities, one associated with the planet's rotation and the other with the orbital revolution of Io. Analysis for fine structure indicated that there is excellent evidence that the important decametric source B has a four-fold structure, with splitting in each coordinate. Records of a number of individual noise storms were also examined in detail. (UK)

1270 INTERPLANETARY RADAR TIME DELAYS IN DIFFERENT THEORIES OF GRAVITATION. Kustaanheimo, P. E. (Finlands Akademi, Helsinki); Oja, H. Celestial Mech.; 8: No. 1, 120-128(Aug 1973).

The first order (in the mass $m$ of the central body) time delay is deduced for all theories of gravitation that satisfy the 3-dimensional principle of equivalence in the one-body problem. It is shown that the curvature of the light ray causes no first order time delay but that the first order time delay is sensitive to the nonlinear term $\beta$ of a general metric when distances $r$ are measured by the periods of circular planetary orbits. (auth)

1271 SOLAR TIDAL FRICTION AND SATELLITE LOSS. Ward, W. R.; Reid, M. J. (California Inst. of Tech., Pasadena). Mon. Notic. Roy. Astron. Soc.; 164: No. 1, 21-32(1973).

This paper treats the dynamical evolution of a satellite orbiting a primary that is being despun by solar tidal friction. The results are then applied to Mercury and Venus. It is concluded that a wide variety of satellites would not have survived the solar tidal braking of these planets. Hence, the absence of satellites around Mercury and Venus is not a compelling reason for thinking that this has always been the situation. Satellites are lost by orbital decay and impact with the primary. It is likely that Mercury would retain a record of such an event on its surface. (auth)

1272 EMANATION CHARACTERISTICS OF TERRESTRIAL AND LUNAR MATERIALS AND THE $^{222}$Rn LOSS EFFECT ON THE U-Pb SYSTEM DISCORDANCE. Barretto, P.M.d.C. Houston, TX; Rice Univ. (1973). 179p. University Microfilms Order No. 73-21,533.

Thesis (Ph. D.).

The activity, emanation rate and percentage of $^{222}$Rn escape were investigated for a variety of soils, rocks, and minerals using $\alpha$-counting techniques. Radon losses on the order of 1 to 20% were found for rock crushed to identical particle size ranges but distinctly higher values, from 10 to 50% were observed for soils. Accessory minerals, although high in uranium concentration, show relatively small radon leakage. The least significant contributors to atmospheric radon are limestones, basalts, serpentinites, and orthoquartzites. Among soils, the sandy are the lowest emanators, whereas the residual types showed the largest radon activity. High temperature experiments (up to 1200°C) on minerals demonstrated a progressive decrease in the percentage of radon loss. This phenomenon is assumed to be the result of annealing of natural radiation damage. Analysis of different grain sizes of volcanic glass and tektites revealed the expected increase in the percentage of radon loss with decreasing particle size. Uniformly low radon escape rates and losses characterize lunar soils. To determine the consequences of radon loss on U-Pb age dating methods, 15 spheres and 20 zircons concentrates were analyzed. Relative percentages of radon loss from 0.2 to 4.4% and 0.2 to 12.0% were observed respectively. The analysis of their emanation characteristics, natural $\alpha$-dose and U-Pb isotopic ratios suggest: (1) a positive correlation between weathering and radon escape, (2) a positive correlation between natural $\alpha$-dose and emanation, and (3) a positive correlation between U-Pb age discordance and percent of current radon emanation. These correlations, as well as the temperature dependence of radon leakage, indicate relationships between radiation damage, radon movement, and lead mobility. Some of the stochastic complexities in specific discordant age determinations are presented. The contributions of radon loss to $^{206}$Pb/$^{238}$U discordance are as follows: (a) a lowering of $^{206}$Pb/$^{207}$Pb ages, (b) an increase in slope of the chords, and (3) a displacement of $^{206}$Pb/$^{238}$U ratios vertically toward the concordia. (Diss. Abstr. Int., B)

1273 ON THE CONTINUUM FLUID APPROACH TO THE SOLAR WIND—MOON INTERACTION PROBLEM. Pérez-de-Tejada, H. (Instituto de Geofísica, Universidad Nacional Autónoma de México, Mexico 20, D.F., Mexico). J. Geophys. Res. 78: No. 10, 1711-1714 (1 Apr 1973).

# PHYSICS (ATMOSPHERIC)

## Auroral and Ionospheric Phenomena

*Refer also to abstracts 1233 and 1781.*

**1274** (N-73-13376) OGO-F-02 DATA ANALYSIS. Final Report. Nagy, A. F.; Silvis, W. M.; Foust, E. C. (Michigan Univ., Ann Arbor (USA). Space Physics Research Lab). Nov 1972. Contract NAS5-9306. 37p. (NASA-CR-130128). NTIS.

The OGO-VI satellite, which was launched on June 5, 1969 carried a complement of twenty-six experiments. One of those instruments, the F-02 package, was a cylindrical Langmuir probe experiment whose primary purpose was to measure ionospheric electron temperatures and densities. The report briefly describes the F-02 experiment itself, outlines the computer programs developed to analyze the raw data, and gives a summary of the scientific information obtained, with the aid of this experiment. (STAR)

**1275** INFLUENCE OF COLLECTIVE EFFECTS IN SOLAR ACTIVITY VARIATIONS ON SOLAR-TERRESTRIAL RELATIONSHIPS. Velinov, P. I. (Geophysical Inst., Sofia). Compt. Rend. Acad. Bulg. Sci.; 26: No. 4, 467-470(1973).

The effect of accelerations and delays in solar activity on the sources of various heliogeophysical and heliobiological processes was determined previously. In order to investigate some unexplained phenomena, some data were reviewed of correlations of solar-terrestrial relationships. The course of the disturbance of night ionospheric absorption was examined for periods involving data from 1950 to 1953; 1959 to 1961; 1960 to 1961; and 1966 to 1967. The data were correlated for the geomagnetic activity index and of the number of type IV solar bursts. The influence on the variations of the sugar content in beets was examined for the year 1914 to 1962 in some regions of the USSR. The investigation of the effects of solar activity on disease incidence in man include the incidence of encephalitis in some regions of USSR for 1939 to 1962 and the incidence of cholera in the world for 1934 to 1950. (MCW)

**1276** SPLITTING OF AN IONOSPHERIC LAYER BY AMBIPOLAR DIFFUSION. Chvojkova, E. (Astronomicky Ustav, Prague). Geofiz. Sb.; 19: No. 345-362, 295-304(1973).

Ambipolar diffusion of electrons is discussed in a Chapman layer in a state of complete hydrodynamic and ionization equilibria. Conditions are analyzed which lead to a splitting of an ionospheric layer by ambipolar diffusion of electrons. (IAA)

**1277** PROBE MEASUREMENT OF THE ELECTROSTATIC FIELD IN THE IONOSPHERE AND MAGNETOSPHERE. Grabowski, R. (Weltraumforschung, Freiburg i. B.). Z. Geophys.; 39: 321-350(Jun 1973). (In German).

Direct and indirect methods of measuring stationary electric fields associated with bulk motions in the ionosphere and magnetosphere are reviewed. The coordinate system in which probe measurements are made is discussed, and the principles on which direct and indirect measurements are based are examined. (IAA)

**1278** RASTPROSTRAANENIE ELEKTROMAGNITNYKH VOLN I IONOSFERA. (Propagation of Electromagnetic Waves in the Ionosphere). Al'pert, Ya. L. Moscow; Izdatel'stvo Nauka (1972). 563p.

The book presents an extensive review of modern theoretical and experimental data on the ionosphere from heights of 50 km to 25,000 km. The propagation of radio waves and electromagnetic waves near the Earth surface and in the ionospheric waveguide is studied, and the principal ground, rocket, and satellite methods used in ionospheric studies are discussed. Much attention is given to the processing and analysis of experimental data. (IAA)

**1279** ANOMALIES IN THE ELECTRON DENSITY OF THE IONOSPHERE AS A POSSIBLE FORERUNNER OF A TASHKENT EARTHQUAKE. Datchenko, E. A.; Ulomov, V. I.; Chernysheva, S. P. (Inst. of Seismology, Tashkent). Dokl. Akad. Nauk Uzb. SSR; No. 12, 30-31(1972). (In Russian).

Probing of ionospheric data was conducted at Tashkent and Alma-Ata stations with the aim of correlating the profile of electron concentration with the Tashkent earthquake of April 26, 1966. An ionospheric anomaly that occurred shortly before the earthquake may have been a forerunner of a plastic deformation of rock near the seismic center. (KSW)

**1280** HELIUM IN THE TERRESTRIAL ATMOSPHERE. Kockarts, G. (Institut d'Aeronomie Spatiale de Belgique, Brussels). Space Sci. Rev.; 14: No. 6, 723-757(Jul 1973).

After a brief historical review of the discovery of helium in the terrestrial atmosphere, the production mechanisms of the isotopes $^4$He and $^3$He are discussed. Although the radioactive production of $^4$He in the Earth is well understood, some uncertainty still exists for the degassing process leading to an atmospheric influx of $(2.5 \pm 1.5) \times 10^6$ atoms cm$^{-2}$ s$^{-1}$. Different production mechanisms are possible for $^3$He leading to an influx of $(7.5 \pm 2.5)$ atoms cm$^{-2}$ s$^{-1}$. Observations of helium in the thermosphere show a great variability of this constituent. The different mechanisms proposed to explain the presence of the winter helium bulge are discussed. Since helium ions are present in the topside ionosphere and in the magnetosphere, ionization mechanisms are analyzed. Owing to possible variations and uncertainties in the solar uv flux, the photoionization coefficient is $(8 \pm 4) \times 10^{-8}$ s$^{-1}$. Finally, the helium balance between production in the Earth and loss into the interplanetary space is discussed with respect to the different processes which can play an effective role. 132 references. (auth)

**1281** RELATIONSHIP OF AURORAL HYDROGEN EMISSIONS TO AURORAL MORPHOLOGY. Stringer, W. J. College, AK; Univ. of Alaska (1973). 194p. University Microfilms Order No. 73-23,785.

Thesis (Ph. D.).

During the winters of 1964-65 and 1965-66 a north-south chain of meridian scanning photometers was operated in Alaska along the dipole 256° meridian effectively gathering auroral spectral photometric data between dipole latitudes 60° and 75°. This work presents the analysis of auroral H-beta and $N_2^+$ 4278-Å MSP measurements as representative of precipitation of energetic protons and electrons. Plots of zenith intensity from dipole latitude 60° to 75° of H-beta and $N_2^+$ 4278 Å were prepared for every fifteen minutes during the night of January 20/21, 1966. When examined in terms of the auroral substorm model, it is found that the most predictable feature of the aurora is the "hydrogen arc." In the evening sector it is always the most equatorward auroral feature. "Break up" always originates in the midnight sector when a narrow, bright, electron-produced arc appears within the broad (~2° of latitude) hydrogen arc near its poleward edge. The electron-proton region "cross-over" in the morning sector was found to represent a statistical averaging including periods of "cross-over" following substorms and periods of superposition of electron and proton emissions during quiet auroral conditions. The "cross-over" occurs approximately thirty minutes following a substorm when the hydrogen arc vanishes and auroral patches occur in its place. During this time, hydrogen emission intensities peak polewards of the peak emission of electron-related emissions. Narrow discrete regions of hydrogen emission coincident with very bright electron-produced auroral arcs are produced by electron impact on atmospheric hydrogen atoms. The fraction of true hydrogen H-beta emission measured by an interference filter photometer answers a long-standing problem regarding the asymmetry of Doppler profile measurements of the H-beta line taken from the magnetic horizon: removal of the $N_2$ VK 2-15 band produces a symmetric profile. An analysis of other auroral emissions that contaminate H-beta auroral photometric measurements was made. In order to investigate the total number flux of protons in the aurora, simultaneous auroral H-beta observations and in situ auroral proton measurements were compared with theoretical predictions relating proton precipitation and photon production. (MCW)

**1282** RESPONSE OF THE IONOSPHERIC F LAYER TO ATMOSPHERIC GRAVITY WAVES AND ASSOCIATED AIRGLOW PHENOMENA. Porter, H. S. Jr. Cincinnati; Univ. of Cincinnati (1973). 114p. University Microfilms Order No. 73-24,841.

Thesis (Ph. D.).

A fully time dependent analytical treatment was developed of F-layer response to disturbances arising either through momentum transfer from the neutral constituents or through ion pair production or loss mechanisms. The ion equation of motion, including an ion drag term, and the ion continuity equation, including a linear loss term and an arbitrary ion pair production term are solved simultaneously using Green's function and integral equation methods. It is assumed that typical horizontal scales for variations in the disturbance are large in comparison to the vertical half width of the F-layer, so that a description using only one spatial dimension is applicable. It is also assumed that the disturbance is sufficiently slowly varying in time that quasistatic equilibrium holds in the ion equation of motion. The treatment includes diffusion, and the linear loss term contains an arbitrary scale height factor p that allows the atmospheric state to vary from perfect mixing (p = 1) to diffusive equilibrium (p = 2). The treatment is applied to calculating the response of the F-layer to passage of atmospheric gravity waves. A simple gravity wave model is chosen that allows the velocity amplitude to be varied from constant with altitude to various degrees of exponential increase. The time dependence is assumed to be sinusoidal. The F-layer response to sinusoidal gravity waves is not in general sinusoidal or even periodic. The F-layer response to gravity waves dies away as the F-layer decays even though the gravity wave itself continues unattended. Fluctuations in the electron density at about two scale heights below the F-layer peak are typically 6 to 8 times larger than fluctuations at the peak. The amplitude of the normalized electron density fluctuation goes asymptotically to a constant value for high altitudes and this value depends upon the degree of the exponential growth exhibited by the wave. The effect of gravity waves on the 6300Å OI and 5200Å NI airglow emissions excited via dissociative recombination is also studied. (MCW)

**1283** INVESTIGATION OF THE IONOSPHERIC RESPONSE TO THE SOLAR ECLIPSE OF MARCH 7, 1970 BY THE THOMSON SCATTER RADAR TECHNIQUE AT THE MILLSTONE HILL IONOSPHERIC OBSERVATORY. Oliver, W. L. Urbana, IL; Univ. of Illinois (1973). 180p. University Microfilms Order No. 73-17,610.

Thesis (Ph. D.).

The Thomson-scatter radar data obtained at the Millstone Hill Ionospheric Observatory on the day of the solar eclipse of Mar. 7, 1970 are reported and analyzed. Values of electron density, electron and ion temperature, and ion composition are obtained throughout the eclipse. The ionospheric response to the eclipse is analyzed in terms of ion chemical processes and in terms of the distribution of solar radiations emanating from the solar atmosphere. Residual ionospheric densities observed at eclipse maximum phase are interpreted in terms of solar coronal emissions and the differential absorption of solar emissions in the ionosphere. The observed ion composition is used to derive values of important ion-neutral reaction rate coefficients. The temperature data are interpreted in terms of the ionospheric response to the large magnetic storm in progress during the eclipse. Independent ion-composition data obtained by rocket at Wallops Island during the eclipse are used to determine nitric oxide concentrations. (auth)

**1284** VERTICAL DISTRIBUTION OF VIBRATIONAL ENERGY OF MOLECULAR NITROGEN IN A STABLE AURORAL RED ARC AND ITS EFFECT ON IONOSPHERIC ELECTRON DENSITIES. Newton, G. P. Washington, DC; Catholic Univ. of America (1973). 160p. University Microfilms Order No. 73-19,022.

Thesis (Ph. D.).

Previous solutions of the problem of the distribution of vibrationally excited molecular nitrogen in the thermosphere have either assumed a Boltzmann distribution and considered diffusion as one of the loss processes or solved for the energy level populations and neglected diffusion. Both of the previous approaches are combined by solving the time dependent continuity equations, including the diffusion process, for the first six energy levels of molecular nitrogen for conditions in the thermosphere corresponding to a stable auroral red arc. The primary source of molecular nitrogen excitation was subexcitation, inelastic, collisions between thermal electrons and molecular nitrogen. The reaction rates for this process were calculated from published cross section calculations. The loss processes for vibrational energy were electron and atomic oxygen quenching and vibrational energy exchange. The coupled sets of non-linear, partial differential equations were solved numerically by employing finite difference equations. The results show that molecular nitrogen is excited vibrationally to the degree that the rate constant for the rate limiting ionospheric loss process $O^+ + N_2 \rightarrow NO^+ + N$ is increased by as much as a factor of eight at $F_2$ region altitudes. It was found that deviations from a Boltzmann distribution caused the reaction rate constant to be as much as 1.7 times the reaction rate constant calculated for the energetically equivalent Boltzmann distributed densities. The time constant for loss of ionospheric electrons was calculated using the enhanced reaction rates. It was found that, for altitudes where the normal loss time constant is less than one day, the loss time constant was decreased in the arc by factors of 1.6 to 5 depending, on altitude. It is concluded that the observed decrease of electron density in the $F_2$ region in stable auroral red arcs can be explained by enhanced reaction rates for ion-atom interchange between $O^+$ and $N_2$ caused by vibrational excitation of molecular nitrogen through electronic collisions. (auth)

**1285** ROCKET-BASED MEASUREMENTS OF AURORAL PARTICLE FLUXES ASSOCIATED WITH FIELD-ALIGNED CURRENTS. Pazich, P. M. Houston, TX; Rice Univ. (1973). 186p. University Microfilms Order No. 73-21,586.

Thesis (Ph. D.).

A rocket-borne auroral particles experiment was launched from Poker Flat, Alaska, over a homogeneous, relatively stable auroral band at 2122 LT on February 24, 1972, designed to measure the field-aligned current carried by energetic (E = 0.5 to 20 kev) auroral electrons and protons by measuring the energy spectrum and angular distribution of these particles. The auroral band was oriented in a magnetic east-west direction and had a visual intensity of >40 kR during most of the flight. Several slight folds developed during the flight and the data indicate the rocket crossed a fold in the band. The most intense fluxes of energetic electrons, on the order of $10^8$ electrons/$cm^2$-sec-ster-keV, were detected near the center of the band. The energy spectrum of these electrons contained a peak at ~10 keV and the angular distribution of intensity increased at small pitch angles. No significant fluxes of protons were observed at any time and significant fluxes of electrons with E > 40 keV were measured only during a short interval near the center of the band. The net field-aligned current carried by precipitating electrons in the energy range E = 0.5 to 20 keV was computed to be $\sim 5 \times 10^{-6}$ amp/$m^2$. The net energy influx due to precipitating electrons was also computed and used with a ground-based measurement of the intensity of 4278-Å emission to determine a value of net energy influx per photon 4278-Å emitted. (auth)

**1286** SCALE INTERACTIONS OF FORCED QUASI-STATIONARY PLANETARY WAVES AT LOW LATITUDES. Abbott, D. A. Tallahassee, FL; Florida State Univ. (1973). 170p. University Microfilms Order No. 73-21,344.

Thesis (Ph. D.).

A numerical model was designed to study the general circulation of the tropical and subtropical summer atmosphere. The initial data consisted of planetary-scale standing waves (zonal wave numbers 0-3) taken from time-averaged July data. The energy of the standing waves was maintained by time-independent, space-dependent diabatic heating. The initial data were integrated from zero to thirty days on a coarse mesh finite difference grid (5° by 5°) and the integrations were then repeated for days twenty-six through thirty on a half-mesh grid. The coarse mesh experiment developed the observable climatological features of the Northern Hemisphere summer atmosphere after a wind-up period of about ten days. At 200 mb the subtropical jets intensified and an easterly jet stream developed near 10°N over the Indian Ocean. At mid levels midlatitude baroclinic cyclone wave (zonal wave numbers 4-10) tracks developed near 55°N. The planetary-scale troughridge patterns vacillated somewhat but the troughs remained over the oceans and the ridges remained over the land areas. Vigorous thermally direct, vertical plane, solenoidal circulations developed. The wave space non-linear energy exchanges were found to be in reasonable agreement with the corresponding statistics calculated from real atmospheric data. It is shown that zonal asymmetries in diabatic heating directly or indirectly provide an important energy source for all of the climatological features. Detailed examination of the barotropic kinetic energy transfers provides a new insight into barotropic processes. Comparison between the result of the coarse and fine grid experiments shows that the barotropic energy conversion process, as reproduced by a numerical model, is strongly dependent on horizontal grid resolution. Nonlinear energy transfers differ substantially in magnitude and in direction of transfer after only forty-eight hours of integration. (auth)

**1287** SHIFT OF REFLECTION POINT IN INHOMOGENEOUS PLASMA UNDER THE ACTION OF AN INCIDENT WAVE. Fraiman, G. M. (Scientific-Research Radiophysics Inst., Gorky, USSR). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 16: No. 8, 1146-1153(1973). (In Russian).

Expressions are derived for the value of the reflection point shift in a smoothly inhomogeneous medium with a local nonlinearity. The criterium of applicability of the averaged description up to the reflection point is found. (auth)

**1288** PARTICLE STREAMS ALONG THE FORCE LINES OF THE MAGNETIC FIELD IN A MULTI-COMPONENT IONOSPHERIC PLASMA IN THE PRESENCE OF LONGITUDINAL CURRENTS. Deminov, M. G.; Sitnov, Yu. S.; Fatkullin, M. N. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 16: No. 8, 1154-1159(1973). (In Russian).

Explicit expressions are derived for the charged particle streams along the magnetic field in a partially ionized ionospheric plasma consisting of two sorts of ions, electrons, and some sorts of neutral particles with taking into account the electric current, pressure, gradients, electric and gravitational fields. For the particular case of a single-ion plasma, the influence of the electric current on the particle streams of separate components is estimated. It is shown that the longitudinal current $I \approx 10^{-5}$ A/$m^2$ which may be realized in the auroral region appears essential for the electron stream; at the same time the ions move practically independently of the current. This is the case when the external electric field, causing the current, is given. (auth)

**1289** REDISTRIBUTION OF CHARGED PARTICLES IN NIGHTTIME E-REGION AT MEAN LATITUDES. Ignat'ev, Yu. A.; Krotova, Z. N.; Nesterov, V. P.; Chasovitin, Yu. K. (Scientific Research Radiophysics Inst., Gorky, USSR). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 16: No. 8, 1164-1171(1973). (In Russian).

The profile of the electron density in the night E-region at mean latitudes is calculated according to the neutral wind measurements. It follows from the comparison of the obtained and experimental profiles that the influence of horizontal winds on the night ionospheric region is shown in the appearance of the irregular structure in the electron density profile. The theory of wind drifts predicts well the heights of appearance of higher ionization layers. When two sorts of ions with essentially different lifetime are taken into account, the maximum values of calculated and experimental electron densities in irregular layers are in satisfactory agreement. (auth)

**1290** SOME STATISTICAL CHARACTERISTICS OF SUDDEN IONOSPHERIC DISTURBANCES AND DISTRIBUTION OF GEOACTIVE CHROMOSPHERIC FLARES OVER THE SOLAR DISC. Belikovich, V. V.; Benediktov, E. A. (Scientific Research Radiophysics Inst., Gorky, USSR). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 16: No. 8, 1133-1137(1973). (In Russian).

During 1959 to 1969, in Gorki, nearly 300 sudden ionospheric disturbances (SID) were registered by the radio astronomical method at the frequency of 13 Mc. The integral distribution of these SID is approximated by the dependence $W(>\Gamma_1) \sim \Gamma_1^{-1.65}$ and when recalculating in a sub-solar point according to the law $\Gamma_0 = \Gamma \cos^{-1} \chi$ by the dependence $W (>\Gamma_1) \sim \Gamma_1^{-1.35}$. The hystograms of the full duration of disturbances and growth rate time of abnormal absorption from its appearance to the maximum are given. The latter appeared somewhat smaller at the beginning of the 11-year cycle of the solar activity. The latitude distribution of chromospheric flares accompanying SID is rather asymmetrical over the solar disc. On the average, in the north hemisphere, such flares are registered 3.5 times greater and for the years close to the minimum of the solar activity (1963 and 1966) 20 times as compared with the south hemisphere. The degree of asymmetry is almost independent of the disturbance intensity. The longitude distribution of flares is characterized by an increase in their number in the region of 30 to 60° e. l. and 60 to 70° w. l. (auth)

**1291** KINETIC THEORY OF ELECTROMAGNETIC WAVES IN ELECTRON PLASMA WITH SLOWLY VARYING PARAMETERS. Pikulin, V. D.; Stepanov, N. S. (Gorky State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 16: No. 8, 1138-1145(1973). (In Russian).

Based on the collisionless kinetic equation, the dielectric tensor of isotropic electron plasma with the parameters slowly varying in time and space is calculated. The pecularities of refraction rays, as well as the change in spectrum, energy, and wave polarization in such a medium are considered in the geometrical optics approximation. (auth)

**1292** LOW-LATITUDE AND EQUATORIAL OUTER IONOSPHERE DURING THE MAGNETIC STORM OF 2–4 JANUARY 1964. Fatkullin, M. N.; Zayarnaya, Ye. S.; Mamonova, L. F. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 196-199(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 228-232(1973).

The data of the Alouette 1 satellite were used to study the effects of disturbances in the daytime outer ionosphere at low and equatorial latitudes during the magnetic storm of January 2–4, 1964. (auth)

**1293** DIFFUSION IN THE F LAYER OF THE IONOSPHERE. Tsedilina, Ye. Ye. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 200-206(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 233-241(1973).

Ionization balance equations taking into account the diffusion were obtained and analyzed for a nonisothermal ionosphere containing two types of positive ions. The spreading of weak inhomogeneities along the magnetic field in such an ionosphere is discussed. It is shown that the distribution of electron and ion concentrations in an ionosphere containing two types of ions is defined by two diffusion equations. In a completely ionized ionosphere containing one type of ions, the electron distribution with height is close to the Boltzmann distribution. The distribution of electron and ion concentrations in such an ionosphere containing two types of ions is much more complex in character and is defined by diffusion type equations. (auth)

**1294** CONVERSION OF THE HEIGHT-FREQUENCY CHARACTERISTIC INTO AN ELECTRON DENSITY PROFILE. Chernyi, F. B. Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 207-213 (1973).

Translated from Geomagn. Aeron.; 13: No. 2, 242-248(1973).

A method is proposed for converting an HFC into an N(z) profile for a nonmonotonic variation of the function N(z). The main feature of the method is an optimum use of information on the valley contained in a single o component of the ionogram. (auth)

**1295** CALCULATION OF N(z) PROFILES OF THE IONOSPHERE USING DATA ON RADIO WAVE ABSORPTION. Danilkin, N. P.; Mal'tseva, O. A. (Rostov State Univ., USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 220-224(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 256-260(1973).

The classes of possible solutions of the problem of N(z) profiles of the ionosphere are discussed in three cases: 1) the experimental base used in the $h'_0(f)$ or $h'_x(f)$ curve, 2) the combined use of $h'_{0,x}(f)$ curves, 3) use of absorption data. It is shown that the categories are broad in the first two cases, and a substantial narrowing down of the category of solutions is reached only in the third case. The indeterminacy of the calculation of profile heights is evaluated. (auth)

**1296** SPORADIC E LAYER AS A RANDOM PROCESS IN TIME. Ovezgel'dyiev, O. (Inst. of Earth Physics and Atmosphere, Turkmen, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 229-232(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 267-271(1973).

It is shown that the temporal variation of sporadic formations is a random process. Empirical autocorrelation functions of the frequency parameters of the layer are determined. A complex spectral composition of the wind shift is the chief cause of random variation of the electron concentration of the $E_s$ layer. (auth)

**1297** PULSED VHF-SOUNDING OF THE $E_s$ LAYER ON A 1620-km LINK. Minullin, R. G.; Mikhaylov, B. K. (Kazan State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 233-235(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 272-275(1973).

Conditions of oblique sounding of the $E_s$ layer on the Odessa–Kazan' link in 1963 and 1965 at frequencies of 34 and 42.5 MHz by pulses of 3.5 and 12 μsec are described. Data on the distortion of the reflected pulses are presented. (auth)

**1298** DETERMINATION OF CHEMICAL REACTION CONSTANTS IN THE D REGION OF THE IONOSPHERE. Zelenkova, L. V.; Pudovkin, M. I.; Sokolov, A. S. (Leningrad State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 236-241(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 276-282(1973).

Data on the ion production rate, calculated from the spectra of penetrating protons during polar cap absorption (PCA), and on the magnitude of riometer absorption were used to obtain constants of the following chemical reactions: attachment in ternary collisions, detachment in collisions, and photodetachment. It is shown that during a PCA, the effective attachment coefficient cannot be a constant characteristic of the D-region. (auth)

**1299** ZONAL NATURE OF CERTAIN DISTURBANCES OF MICROPULSATIONS AT THE GEOMAGNETIC POLE. Bol'shakova, O. V.; Khorosheva, O. V. (Inst. of Earth Physics, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 294-297(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 343-346(1973).

SSP recordings at the geomagnetic pole were used to detect intense disturbances ($PD_a$) constituting a set of pulsations with T ~ 3-7 min, on which irregular pulsations of periods T ~ 10-100 sec are superimposed. The source of $PD_a$ was localized. It is postulated that the cause of $PD_a$ may be oscillations of the magnetotail. (auth)

**1300** NATURE OF THE AURORAL ELECTROJET. Van'yan, L. L.; Debabov, A.S.; Osipova, I. L. (Space Research Inst., Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 278-281(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 325-329(1973).

The existing hypotheses explaining the nature of the jet current in the auroral zone are analyzed. An example of a model of a gyrotropic plane ionosphere containing an elliptical conductivity inhomogeneity is used to show that the most effective mechanism for the creation of the auroral electrojet is a magnetospheric current flowing in in the morning sector and flowing out in the evening sector. This case is subjected to a detailed analysis. (auth)

**1301** COMPARISON OF THE TRUE AND VIRTUAL HEIGHTS OF THE SPORADIC E LAYER. Mal'tseva, O. A.; Chernysheva, S. P.; Sheftel, V. M. (Rostov State Univ., USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 311-313(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 361-362(1973).

Analysis of heights of the sporadic E-layer almost always involves the use of virtual heights instead of true ones, i.e., the difference $\delta h'E_s = h'E_s - hE_s$, determined by the group delay in the underlying region, is neglected. However, such neglect is often far from justified and may cause the physical picture of the behavior of the heights of $E_s$ to be distorted. Here data of vertical sounding of the ionosphere at Rostov-on-Don were used to analyze the diurnal and seasonal variations of $h'E_s$ and the influence of $\delta h'E_s$ on them for $E_s$ layers of different types. Values of the true heights of $E_s$ were obtained by calculating the N(h) profiles on a computer. (MHR)

1302 STUDY OF TRAVELING IONOSPHERIC DISTURBANCES. Drobshev, V. I.; Rybin, V. A. (Ionosphere Sector, Kazakh, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 318-321(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 369-371(1973).

Experimental results obtained by the interference method are described. On the interferograms, attention is drawn to the zero beats (zeros) corresponding to the frequency f(0), at which $\Delta L_{gr} = 0$ Analysis of diurnal variations showed a strictly regular zero drift from day to day in the course of a month, the most probable value of the period being 25 to 30 min. To account for the experimental data obtained, model calculations were performed that were based on the assumption that a constant-acting source of waveform disturbance of the electron concentration was present. (MHR)

1303 INITIAL RESULTS OF OBSERVATIONS OF DRIFTS IN THE IONOSPHERE AT MAGADAN. Seryi, V. M.; Denisenko, N. M. (Northeastern Scientific Center, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 321-322(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 372(1973).

An electronic device for studying the drift of large-scale inhomogeneities in the ionosphere by the method of spatially separated reception was constructed by using an IRX ionosonde as the basic element. The observations were made by using the ordinary component at a frequency of $4 \pm 0.1$ MHz at effective heights of 225 to 260 km. Recordings of the motion of small-scale ionization inhomogeneities of the $F_2$-layer during the daytime hours in November and December 1967 were processed. Analysis of the data showed that southwestern drift azimuths predominate at that time (210 to 250°). Data of observations of drifts at Magadan do not exhibit any large discrepancies with the results obtained in Irkutz during the period 1957-67. (MHR)

1304 MOTION OF AURORAS IN THE COURSE OF A SUBSTORM. Lyatskaya, A. M.; Lyatskii, V. B. (Polar Geophysical Inst., Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 324-326(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 375-376(1973).

The motions of auroras in the course of a substorm were investigated based on data of maps of auroral intensities above Syowa ($\phi' = 66.7°$). Data were obtained with a scanning photometer for several months of 1967. The contours of equal auroral intensity, averaged over 16 substorms, are shown. The substorms were chosen so that no other substorm was observed for 1 hour before the commencement of the active phase. (MHR)

1305 MODEL OF DISTRIBUTION OF INTEGRAL TRANSVERSE CONDUCTIVITY OF THE IONOSPHERE. Soboleva, T. N. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 310-311(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 359-360(1973).

The latitudinal, diurnal, and cyclic dependences of the values of the integrated transverse conductivity of the ionosphere along the meridian ~75°W are studied. Results of the calculation are compared with those available in the literature and are approximated analytically. (MHR)

1306 VHF DOPPLER SPECTRA OF RADAR ECHOES ASSOCIATED WITH A VISUAL AURORAL FORM: OBSERVATIONS AND IMPLICATIONS. Balsley, B.B. (NOAA Aeronomy Laboratory, Boulder, Colorado, 80302); Ecklund, W.L.; Greenwald, R.A. J. Geophys. Res. 78: No. 10, 1681-1687 (1 Apr 1973).

Detailed analysis of a relatively uncomplicated premidnight auroral event shows that there can be a close correspondence between visual auroral and radar auroral forms. The radar echoes are not exactly spatially coincident with the visual form, but they occur near the equatorward edge. High-resolution Doppler radar data are consistent with the picture of a horizontal current flowing near the equatorward edge of the form. There is some evidence that the two-stream instability is a causal mechanism for producing some of the radar auroral irregularities; there is additional evidence indicating that the gradient drift mechanism may also play a major role. (auth)

1307 PITCH ANGLE DIFFUSION OF LOW-ENERGY AURORAL ELECTRONS. Whalen, B.A.; McDiarmid, I.B. (Division of Physics, National Research Council, Ottawa, Ontario, Canada). J. Geophys. Res. 78: No. 10, 1608-1614 (1 Apr 1973).

Sounding rocket observations of electron pitch angle distributions in the 2- to 60-kev energy range, measured in a postbreakup aurora, are presented, which indicate that the electron precipitation resulted from the loss of newly injected particles from a region of closed geomagnetic field lines, the loss mechanism being associated with pitch angle diffusion. Diffusion coefficients for these particles were determined by fitting the measured angular distributions to calculated loss cone distribution functions. The variation in the value of the coefficient with energy is shown to be consistent with diffusion resulting from two sources. Electrostatic wave turbulence is invoked to explain the large coefficients at low energies ($E < 5$ kev). Agreement is also obtained at higher energies by postulating a pitch angle dependent diffusion coefficient, the coefficient increasing rapidly with pitch angle. (auth)

1308 DISTRIBUTIONS AND CHARACTERISTICS OF HIGH-LATITUDE FIELD-ALIGNED ELECTRON PRECIPITATION. Berko, F.W. (Laboratory for Space Physics, NASA Goddard Space Flight Center, Greenbelt, Maryland, 20771). J. Geophys. Res. 78: No. 10, 1615-1626 (1 Apr 1973).

Satellite measurements of field-aligned auroral electron precipitation have been analyzed using 16 months of data from the Ogo 4 auroral particles experiment. As can be seen from the moving satellite, the anisotropies are of short duration and are most likely to occur when particle fluxes are high. Field-aligned 2.3-kev electron precipitation is found in an oval-shaped region primarily in the nighttime hours; maximum probability is at $\approx 70°$ invariant latitude near midnight, congruent to and poleward of the auroral optical emissions in these hours. This precipitation is found to be associated with the high-latitude boundary of auroral electron precipitation during substorm expansion and is characterized by a slightly harder and considerably more intense energy spectrum than typical isotropic precipitation. (auth)

1309 A STUDY OF IONOSPHERIC ABSORPTION IN CONJUGATE REGIONS PRODUCED BY STORM SUDDEN COMMENCEMENTS AND SUDDEN IMPULSES IN THE GEOMAGNETIC FIELD. Brown, R.R. (Department of Physics, University of California, Berkeley, California, 94720). J. Geophys. Res. 78: No. 10, 1668-1672 (1 Apr 1973).

Riometer data from Syowa, Antarctica, and Reykjavik, Iceland, were analyzed for the occurrence of sudden commencement (sc) and sudden impulse (si) absorption events over a 35-month period (February 1967 to December 1969). The results of this study include the fraction of sc and si that produce ionospheric absorption at $L = 6.3$, the fraction of sc and si events that show absorption effects in conjugate regions, and the magnetic local time distributions of these events. The occurrence probability for conjugate events, plus other spatial features of these events, suggests a scale size of $\approx 6 \times 10^4$ km for solar plasma at the boundary of the magnetosphere. (auth)

1310 OBSERVATIONS OF NARROW MICROBURST TRAINS IN THE GEOMAGNETIC STORM OF AUGUST 4-6, 1972. Brown, R.R. (Department of Physics, University of California, Berkeley, California, 94720). J. Geophys. Res. 78: No. 10, 1727-1729 (1 Apr 1973).

In the intense geomagnetic disturbances of early August 1972, auroral zone microburst trains were observed at balloon altitude and found to be significantly narrower in burst width and spacing than microbursts found previously at the same site. These observations suggest that the spacing of microburst peaks, as well as their width, is related to variations in the power spectrum of a magnetospheric acceleration process rather than the bounce motions of electrons in the geomagnetic field or the modulation of electron precipitation by drift waves in magnetospheric plasma. In the geomagnetic activity that followed the solar flares in early August 1972, intense fluxes of auroral x rays were encountered during balloon flights launched from College, Alaska. Although much of the time variations of the x-ray fluxes observed during these flights represented known features of electron precipitation at auroral latitudes, one new and distinct feature was evident. In particular, it was found that the widths and spacings of auroral zone microbursts (Anderson and Milton, 1964) on this occasion were significantly smaller than those observed previously on many balloon flights from the same site. Thus, instead of microburst trains with widths at half-intensity points of ~0.2 sec and spacings of ~0.6 sec, the majority of the microbursts encountered on two flights from College had widths of ~0.1 sec and spacings of ~0.4 sec. (auth)

1311 CORRESPONDENCE OF MAIN TROUGH ION TEMPERATURES WITH HORIZONTAL DRIFT SPEED. Bates, H.F.; Belon, A.E.; Watkins, B.; Hunsucker, R.D. (Geophysical Institute, University of Alaska, Fairbanks, Alaska, 99701); Baron, M.J. J. Geophys. Res. 78: No. 10, 1723-1726 (1 Apr 1973).

Incoherent scatter measurements in the main ionospheric trough show that F-region ion temperatures and horizontal drift speeds increase together. Temperatures and drift speeds correlate better with local magnetic activity than with planetary activity. Coincident neutral temperatures were obtained optically; the difference between ion and neutral temperatures increases with horizontal ion drift speed. It is concluded that F-region ion temperatures are increased in the presence of an enhanced horizontal ionospheric electric field. The heating mechanism for the ions is probably Joule heating by the Pederson current associated with the electric field. (auth)

## Magnetospheric Phenomena

*Refer also to abstracts 1113 and 1833.*

**1312** MAGNETOSPHERE OF THE EARTH. Szemeredy, P. (Eotvos Lorand Univ., Budapest). Magy. Fiz. Foly.; 21: No. 3, 245-259(1973). (In Hungarian).

The goal of magnetosphere research is to develop a model able to explain the correlations between the phenomena observed in the upper atmosphere, indicating the interactions between the solar wind and the terrestrial magnetic field. Recent research in this area is reviewed, presenting equations that describe the flow of the solar wind as a specific case of supersonic gas flow, assuming that the flowing plasma carries away the magnetic field. Vortices in the magnetosphere reduce the electric conductivity of the plasma. The electric field prevailing in the magnetosphere is strongly amplified during magnetosphere showers, generating extensive plasma streams. (TTT)

**1313** INTRODUCTION TO THE DIPOLE THEORY OF RADIATION BELTS. Gombosi, T. (Central Research Inst. for Physics, Budapest). Magy. Fiz. Foly.; 21: No. 3, 261-289(1973). (In Hungarian).

After reviewing the experimental studies on the location of terrestrial proton and electron belts, the dipole theory of radiation belts is described, indicating also several as yet unresolved dynamic problems. This involves description of charged particles in a magnetic dipole field, indicating Hamilton formalism for rotational and symmetric electromagnetic fields, forbidden zones in the meridian plane of dipoles, the motion of guiding centers, and adiabatic invariants in magnetic dipole fields. The equations that control the belts created by trapped charged particles are then derived, with a review of the physical phenomena responsible for the time-dependent variations of radiation belts. (Review article, 9 references). (TTT)

**1314** PLASMA IN THE GEOMAGNETIC TAIL OBSERVED BY THE CHARGED PARTICLE LUNAR ENVIRONMENT EXPERIMENT. Rich, F. J. Houston, TX; Rice Univ. (1973). 148p. University Microfilms Order No. 73-21,590.

Thesis (Ph. D.).

A study of the characteristics of the plasma sheet in the magnetotail based on the data obtained with the Charged Particle Lunar Environment Experiment (CPLEE) was made. A study of lunar surface–plasma sheet interactions is taken up and the electrostatic field associated with the photoelectron layer is found to consist of a surface potential $\lesssim$50 V and an overshoot potential of $\gtrsim$ –50 V above the surface. The shadowing of particles at the CPLEE location by the lunar disk is shown generally not to occur for plasma sheet particles. This may be due to rapid, random passage ($\gtrsim$40 km/sec) of magnetotail field lines with respect to the lunar surface and/or to diffusion of plasma sheet electrons into the flux tubes in contact with the lunar surface. Charge separation in the plasma sheet near the Moon due to the unequal precipitation of plasma sheet ions and electrons onto the surface does not occur due to the return flow of low energy photoelectrons and/or secondary electrons from the surface to the plasma sheet. In short, neither the above effects nor any other effects significantly alter the flux of plasma sheet particles reaching the CPLEE. Analysis of CPLEE data shows that typical quiet time parameters for the plasma sheet at lunar distance are $n = 0.10 \pm 0.05$ cm$^{-3}$, $kT_e =$ 200 ± 50 eV, and $kT_i = 2.5 \pm 0.75$ keV. The typical ranges for the parameters are 0.05 to 0.20 for n, 175 to 325 eV for $kT_e$, and 1 to 5 keV for $kT_i$. The typical total (plasma plus magnetic) energy density is in the range 150 to 350 eV/cm$^3$. A statistical analysis of the data shows that the plasma sheet in the midnight sector of the magnetotail at lunar distance has a thickness of $5R_e \pm 2\ R_e$. An aliasing due to the matching of the solar synodic rotation period, the mean lunar nodical period, and the synodic month is found to have an effect on the locating of the plasma sheet by the CPLEE. It has been found that substorms reduce the probability of the Moon encountering the plasma sheet. An examination of data at lunar distance, at Vela distance, and at auroral zone magnetometer stations for March 12, 1971 shows that events at the lunar distance lagged behind events at Vela distances by 30 to 90 minutes. (auth)

**1315** ABSORPTION OF HYDROMAGNETIC WAVES IN THE PLASMA SHEET OF THE MAGNETOSPHERIC TAIL. Potapov, A. S. (Siberian Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Irkutsk, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 326-328(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 377-378(1973).

The dissipation associated with the presence of collisionless damping of hydromagnetic waves is evaluated. The treatment is confined to fast magnetosonic waves. A simplified model of the geomagnetic tail in the form of a system of plane-parallel sheets was chosen. It is assumed that the lines of force of the magnetic field are everywhere parallel (or antiparallel) to each other and to the boundaries of the sheets. (MHR)

**1316** ELECTRIC FIELD IN THE MAGNETOSPHERE UNDER QUIET CONDITIONS BASED ON GROUND OBSERVATIONS OF WHISTLERS. Sobolev, Ya. P. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 329-331(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 379-381(1973).

An analysis was performed of whistlers recorded at Riga ($\phi =$ 54.2°N, L = 2.92) on 16 October 1965 continuously for two hours (12 to 14h LT). Sonograms of two whistlers pertaining to the initial and final observation periods are shown. (MHR)

**1317** RELATION BETWEEN THE PERIOD OF GEOMAGNETIC PULSATIONS Pc3, 4, AND THE PARAMETERS OF THE INTERPLANETARY MEDIUM AT THE EARTH'S ORBIT. Gul'yel'mi, A. V.; Plyasova-Bakunina, T. A.; Schehepetnov, R. V. (Inst. of Earth Physics, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 331-334(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 382-383(1973).

Comparison of ground and satellite data made it possible previously to establish the dependence of the period of Pc3, 4 pulsations on the radius of the magnetosphere, solar wind velocity, magnitude of the magnetic field, and plasma density ahead of a shock front. Here, a quantitative estimate is made of the degree of correlation between the pulsation period and the above parameters. (MHR)

**1318** EXPONENTIAL DISTRIBUTIONS OF PROTONS OF THE OUTER RADIATION BELT OVER ADIABATIC INVARIANTS. Gubar, Yu. I.; Shabanskii, V. P. (Moscow State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 305-307(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 355-356(1973).

A stationary one-particle function of a statistical distribution of particles is considered as a function of adiabatic invariants. The distribution is compared with the observed stationary distributions of low-energy protons in the Earth's radiation belts. The work is confined to the treatment of exponential distribution over the third adiabatic invariant. (MHR)

**1319** RADIATION AT THE BOUNDARY OF THE MAGNETOSPHERE. Kovner, M. S. (Gorky State Univ., USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 262-265(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 306-310(1973).

Excitation of plasma oscillations in the magnetopause and their subsequent transformation into electromagnetic waves are examined. Estimates of the intensity of magnetic bremsstrahlung and radiation at the boundary of the magnetosphere are given. (auth)

**1320** DAMPING OF HYDROMAGNETIC WAVES IN A TURBULENT PLASMA. Liperovskii, V. A.; Mart'yanov, S. A. (Inst. of Space Research, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 266-271(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 311-317(1973).

The damping decrement of hydromagnetic waves is evaluated in a weakly turbulent plasma in the case of high and low frequencies (in comparison with the reciprocal time of isotropization of the pulsation spectrum). The basis used for the approach is ion-acoustic turbulence. (auth)

**1321** DYNAMICS OF LONGITUDINAL CURRENTS IN THE MAGNETOSPHERE. Gudkova, V. A.; Zelenyi, L. M.; Liperovskii, V. A. (Inst. of Space Research, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 272-277(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 318-324(1973).

The temporal evolution of ion-acoustic turbulence in the magnetosphere is discussed. The generation of turbulence is attributed to currents and electric fields along the lines of force of the magnetic field. The turbulence-caused anomalous dissipation of longitudinal currents is the cause of a gradual heating up of the plasma. One way of diagnosing this phenomenon is to study the damping of the short-period pulsations of the magnetic field that correspond to hydromagnetic waves in the magnetosphere. As is shown by calculation, the damping should decrease with rising plasma temperature and hence with time. Damping decrements of short-period pulsations observed against a background of sufficiently strong bays are analyzed. It is seen that the decrement has a tendency to decrease with increasing time. (auth)

1322 PATTERNS IN THE RATE OF DECAY OF THE RING CURRENT. Shevnin, A. D. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 282-285(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 330-334(1973).

When additional intensifications of the ring current are excluded, the rate of its decay depends on the maximum decrease of $D_{st}$ variation and decreases along a tangent to an exponential curve during the recovery phase. The decay time is almost one order of magnitude shorter than the generally accepted value. (auth)

1323 RELATIONSHIP BETWEEN OBSERVED AND SYNTHESIZED $S_q$ FIELDS. Borisova, V. P. (All-Union Inst. of Geophysical Prospecting Methods, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 286-289(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 335-338(1973).

On the basis of a comparison of observed components of the $S_q$ field for 1958 with field components synthesized in a system of normalized $S_q$ coordinates, a network of observatories is selected in which the field is not complicated by local geoelectric inhomogeneities. (auth)

1324 SEPARATION OF VARIABLE GEOMAGNETIC FIELD INTO THE NORMAL AND ANOMALOUS PARTS. Berdichevskii, M. N.; Zhdanov, M. S. (Moscow State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 290-293(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 339-342(1973).

As the distance from the earth's surface increases, the normal and anomalous parts of the variable geomagnetic field change in accordance with different laws. On this basis, a method is proposed for separating the field into the normal and anomalous parts, the use of this method making it necessary to know the resistivity of the medium containing the inhomogeneity. (auth)

1325 PLASMA AND FIELDS IN THE VICINITY OF A RAPIDLY MOVING BODY IN THE PRESENCE OF AN EXTERNAL MAGNETIC FIELD. Moskalenko, A. M. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 2, 191-195(1973).

Translated from Geomagn. Aeron.; 13: No. 2, 223-227(1973).

Disturbances of the particle density and of the electric and magnetic fields in the vicinity of a body moving rapidly in a rarefied plasma in the presence of an external magnetic field were studied. For the density of particles and fields, analytical expressions were obtained that apply at large distances in the plane passing through the vectors of velocity of the body and external magnetic field, and at arbitrary distances in the perpendicular direction. (auth)

1326 ON THE RELATIONSHIP BETWEEN THE GROWTH AND EXPANSION PHASES OF SUBSTORMS AND MAGNETOSPHERIC CONVECTION. Mozer, F.S. (Physics Department and Space Sciences Laboratory, University of California, Berkeley, California, 94720). J. Geophys. Res. 78: No. 10, 1719-1722 (1 Apr 1973).

Since there is experimental evidence from electric field measurements for the existence of growth and expansion phases of substorms, the validity of these concepts as defined in terms of magnetospheric convection becomes established if the electric field data are accepted. These data may be questioned from several points of view that are discussed. (WDM)

1327 MAGNETOSHEATH OBSERVATIONS AT HIGH NORTHERN LATITUDES BY HEOS 2. Hedgecock, P.C. (Physics Department, Imperial College of Science and Technology, London, England); Cerulli, P.; Coletti, A.; Egidi, A.; Marconero, R.; Domingo, V.; Köhn, D.; Page, D.E.; Taylor, B.G.; Wenzel, K.-P. J. Geophys. Res. 78: No. 10, 1715-1718 (1 Apr 1973).

Preliminary results are presented on two early outbound magnetopause crossings at high northern ecliptic latitude observed by the magnetometer, plasma, and particle experiment on the ESRO satellite Heos 2, which was launched on January 31, 1972. The orbit and mission of the satellite are unique in so far as the satellite is to carry out measurements on particles and fields in the high-latitude magnetosphere and magnetosheath, near the polar cusp, to map the topology of the boundaries and to make measurements in interplanetary space. (WDM)

1328 MAGNETIC FIELD SIGNATURES OF SUBSTORMS ON HIGH-LATITUDE FIELD LINES IN THE NIGHTTIME MAGNETOSPHERE. Fairfield, D.H. (Laboratory for Extraterrestrial Physics, NASA Goddard Space Flight Center, Greenbelt, Maryland, 20771). J. Geophys. Res. 78: No. 10, 1553-1562 (1 Apr 1973).

Two types of magnetic field changes are repeatedly observed in the high-latitude nightside magnetosphere in association with magnetic substorms. One type of field change occurs on field lines associated with the high-latitude part of the auroral oval and is characterized by a sudden decrease in the field strength accompanied by an abrupt perturbation in the field declination angle. These changes are attributed to field-aligned sheet currents flowing on the high-latitude boundary of an expanding plasma sheet following substorms. Single sheets of field-aligned currents on this boundary tend to flow toward the earth in the morning quadrant and away from the earth in the evening quadrant. Multiple sheets of current may also occur, the direction of the high-latitude sheet generally being the same as that of a single sheet. A second type of field change observed on polar cap field lines is a decrease in field inclination during substorms. This type of change is regarded as a further manifestation of the changing field configuration during substorms and can be described in terms of azimuthal currents. (auth)

1329 CONJUGATE ASYMMETRIES IN SUDDEN COMMENCEMENT ABSORPTION AND THE SUDDEN COMMENCEMENT ABSORPTION EVENT OF FEBRUARY 28, 1969. Phillips, J. (Physics Department, University of Tasmania, Hobart, Tasmania, Australia). J. Geophys. Res. 78: No. 10, 1563-1571 (1 Apr 1973).

A balloon observation of sudden commencement X rays (up to 2 times background) was made near Macquarie Island $(\lambda=-61^\circ)$ at 0423 UT on February 28, 1969. A synoptic study of this event using riometer data, reveals that in the morning sector of the auroral zone the pattern of sudden commencement absorption (sca) is similar to that inferred from previous statistical studies. The situation in the afternoon sector is not clear. The sca at College was 10 times greater than that at Macquarie Island, and thus an asymmetry in sca between stations occupying positions of near conjugacy is indicated. A restricted period of data from the conjugate stations Great Whale River and Byrd reveals two other asymmetrical sca events. It is suggested that asymmetries in conjugate sca, and perhaps variations in the longitudinal distribution of sca, occur when a solar wind shock normal makes a large angle with the geomagnetic equatorial plane or the sun-earth line. (auth)

1330 VLF PROPAGATION DISTURBANCES AND ELECTRON PRECIPITATION AT MID-LATITUDES. Potemra, T.A. (Applied Physics Laboratory, Johns Hopkins University, Silver Spring, Maryland, 20910); Rosenberg, T.J. J. Geophys. Res. 78: No. 10, 1572-1580 (1 Apr 1973).

Observations of nighttime phase disturbances to long-distance mid-latitude $(2 \leq L \leq 4)$ VLF transmissions during a magnetospheric substorm on January 2, 1971, are presented. The onset of the phase disturbances to a number of VLF paths began at the time of the substorm expansion. Whistler measurements during this event indicate that all the paths were below the plasmapause. Bremsstrahlung X rays and VLF emissions were observed above the plasmapause, near $L=4$, simultaneously with the VLF propagation distrubances. A previous analysis of the X ray and VLF emission data indicates that electron precipitation at $L=4$ was caused by cyclotron resonance between energetic trapped electrons and whistler mode VLF waves near the equatorial plane. The data presented here suggest that the mid-latitude ionospheric disturbances are due to energetic electron precipitation, which is possibly caused by this same mechanism. For this event it is estimated that a flux of electrons $J(>40 \text{ kev}) \lesssim 300/\text{cm}^2$ sec ster with e-folding energy equal to 45 kev will account for the measured phase change along a path nearly parallel to $L=3$. Calculations illustrate that nighttime VLF phase is very sensitive to values of incident electron flux that are only marginally detectable, if at all, with the more conventional indirect indicators of electron precipitation, e.g., X rays and riometer absorption. This suggests that VLF propagation can serve as a useful tool for the detection of low-intensity electron precipitation. (auth)

1331 OBSERVATIONS OF NOISE BANDS ASSOCIATED WITH THE UPPER HYBRID RESONANCE BY THE IMP 6 RADIO ASTRONOMY EXPERIMENT. Mosier, S.R.; Kaiser, M.L.; Brown, L.W. (Radio Astronomy Branch, Laboratory for Extraterrestrial Physics, Goddard Space Flight Center, Greenbelt, Maryland, 20771). J. Geophys. Res. 78: No. 10, 1673-1679 (1 Apr 1973).

The intense noise bands occurring near the upper hybrid resonance frequency have been observed with the Imp 6 GSFC radio astronomy experiment in the plasmasphere. The identification of the upper hybrid resonance provides an accurate measure of the local electron density and allows the observed noise data to be fit to the scale of characteristic frequencies in the plasma. The data are consistent with earlier theoretical interpretations in which noise is generated between the upper hybrid and plasma frequencies and propagates to region 4 of the CMA diagram, where it is reflected at the $L=0$ plasma cutoff. (auth)

1332 DAILY VARIATION OF GEOMAGNETIC FIELD AT THE INDIAN STATIONS UNDER THE ELECTROJET DURING

**THE PERIOD OF THE JULY 1966 PROTON FLARE.** Sastry, T.S.G. (Physical Research Laboratory, Ahmedabad, India). J. Geophys. Res. 78: No. 10, 1692-1698 (1 Apr 1973).

A rocket-borne magnetometer was launched from Thumba on July 7, 1966, at 1345 IST (0815 UT) to study the quiet day equatorial electrojet. The results from this flight indicated the presence of a second current layer with a broad maximum near 140-km altitude, but the existence of this layer could not be confirmed. The analysis presented here shows that a second current layer was in fact present on July 7 at the time of the flight. The study further shows that the gradual buildup of the amplitude of H variation at the low-latitude stations during the period July 1-6 before the proton flare is due to gradual enhancement in this period of the slowly varying component of the ionizing radiation from the sun. It is suggested that the formation of a second current layer at 140-km altitude observed during the flight is due to the increased emission of XUV radiation over a wide spectral band during the flare. (auth)

# PHYSICS (ATOMIC AND MOLECULAR)

## Beams and Their Reactions

*Refer also to abstract 1023.*

**1333** MEASUREMENTS OF THE ATOMIC BEAM FORMED BY A FOCUSING CAPILLARY ARRAY. Lucas, C. B. (Univ., Muenster, Ger.). J. Phys., E (London); 6: No. 10, 991-994 (Oct 1973).

The properties of a helium atomic beam formed by a fused glass focusing array of about $10^7$ capillaries each 5 $\mu$m in diameter and 2.5 mm long, the axes of which are directed to a point 50 mm from the array were investigated. The axial atom density and the total throughput are consistent with Zugenmaier's theory for a single capillary (Z. angew. Phys.; 20: 184-8 (1966)). The beam halfwidth is anomalously six times wider than expected theoretically, but it is shown that this is not primarily due to a constructional error in the array. An axial helium density of $10^{14}$ atoms/cm$^3$ at a beam width of 5 mm was obtained at an input pressure of 2 Torr, with a total helium throughput of $1.5 \times 10^{19}$ atom/s. (auth)

**1334** SPUTTERING OF OXIDES. 1. A Survey of the Experimental Results. Kelly, R.; Lam, N. Q. (McMaster Univ., Hamilton, Ont.). Radiat. Eff.; 19: No. 1, 39-48(May 1973).

From international conference on ion-surface interaction, sputtering, and related phenomena; Garching, Germany (Sep 1972).

The sputtering behavior of oxides is now fairly well understood in 12 cases. Three categories can be recognized, with some oxides belonging to more than one category. The eight oxides $Al_2O_3$, MgO, $Nb_2O_5$, $SiO_2$, $Ta_2O_5$, $TiO_2$, $UO_2$, and $ZrO_2$ have sputtering coefficients as expected from Sigmund's (Phys. Rev.; 184: 383 (1969)) theory of collisional sputtering, at least provided the surface binding energy can be identified with the heat of atomization. The four oxides $MoO_3$, $SnO_2$, $V_2O_5$, and $WO_3$ show high and (except possibly with $SnO_2$) temperature-dependent sputtering coefficients such that the inferred surface binding energies are significantly less than the heats of atomization. For example, $V_2O_5$ has $S = 12.7$ atoms/ion for 10-keV Kr, so that $E_b$ is apparently 1.3 eV/atom as compared with 5.7 eV/atom for atomization. This is taken as evidence for thermal sputtering. The five oxides $MoO_3$, $Nb_2O_5$, $TiO_2$, $V_2O_5$ and $WO_3$ show preferential oxygen sputtering, such that they first amorphize, then lose oxygen, and finally crystallize as the phases $MoO_2$, NbO, $Ti_2O_3$, $V_2O_3$, and $W_{18}O_{49}$. A comparison between corresponding oxides and metals is also possible with the information available. The main result is that the ratio $S_{oxide}/S_{metal}$ is normally greater than unity ($Al_2O_3$, MgO and $TiO_2$ are exceptions), the ratio $(S_{oxide}/S_{metal})$ (mole fraction of metal in the oxide) is normally less than unity ($V_2O_5$ is an exception). (auth)

**1335** RESPUTTERING EFFECTS BY MEASUREMENTS OF ANGULAR DISTRIBUTIONS. Krueger, W.; Roedelsperger, K.; Scharmann, A. (Univ., Giessen, Ger.). Z. Phys.; 262: No. 4, 315-326(1973).

Angular distributions of copper atoms sputtered at bombarding energies between 100 and 1,000 keV from polycrystalline targets are measured by a collector method using noble gas ions. The deposit was detected immediately after bombardment with a photometer placed in the sputtering chamber. This arrangement allowed series of measurements to be performed at different ion doses without oxidation of the film. Because of the fastness of this method a large number of distribution profiles showing principle errors of the collector method effected by condensation coefficients lower than one was obtained. The angular distributions are described without influence of these errors by the angle of maximum emission and the base width of the distributions. (orig.) (GE)

**1336** SCATTERING OF HYDROGEN, DEUTERIUM, AND THE RARE GASES FROM SILVER (111) SINGLE CRYSTALS. Sau, R.; Merrill, R. P. (Univ. of California, Berkeley). Surface Sci.; 34: No. 2, 268-288(Jan 1973).

The scattering of hydrogen, deuterium, and the rare gases from the (111) face of silver was studied in ultrahigh vacuum. Surfaces were prepared by argon ion bombardment and high-temperature annealing. Incident angles between 20 and 65° and surface temperatures between room temperature and 573°K were investigated. The scattering data exhibit quasi-elastic scattering (He, $H_2$, $D_2$), inelastic scattering (Ne, Ar, Kr), and trapping-dominated scattering (Xe). Identification of these scattering regimes correlates with $D/kT_g$ and is consistent with similar data from Pt(111) and W(110). The separate effects of microscopic surface roughness and thermal roughening were identified and thermal attenuation in the elastic regime correlated with dynamical interactions rather than thermal roughening. Trapping and rotational coupling are discussed. Comparison of the data with scattering from epitaxial (111) silver indicates that the epitaxial surfaces are significantly more disordered than the single-crystal surfaces. (11 figures, 3 tables, 27 references) (auth)

**1337** ANGULAR DEPENDENCE OF INTENSITY, CHEMICAL SHIFT, AND FINE STRUCTURE OF THE DISCONTINUOUS COMPTON SCATTERING. Muehle, P. (Univ., Munich). Phys. Lett.; 44A: No. 5, 315-316(2 Jul 1973).

The angular dependence of the intensity, the chemical shift, and the fine structure of discontinuous Compton radiation scattered by the K-electrons of Be, BeO, Li, and LiF were studied. Discrete lines resulting from scattering by L-electrons were observed in the case of Na, Al, and Si. (auth)

**1338** EXPERIMENTAL STUDY OF VELOCITY DISPERSION IN SCREW ELECTRON BEAMS. Avdoshin, E. G.; Nikolaev, L. V.; Platonov, I. N.; Tsimring, Sh. E. (Scientific-Research Radiophysics Inst., Gorky, USSR). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 16: No. 4, 613-621(1973). (In Russian).

It is experimentally shown that roughnesses of the emitter surface, the initial velocity of electrons and the spatial charge field influence the oscillator velocity dispersion in screw beams formed by magnetron-injection guns. The measured values of the total spread under the action of the above factors reach 10 to 20% in real beams. The investigated types of emitters are briefly characterized and the methods of measuring the velocity dispersion are given. The experimental data are compared with theoretical estimations. (auth)

## Atomic and Molecular Properties

*Refer also to abstract 999.*

**1339** ELECTRIC FIELD GRADIENT AND MAGNETIC SPIN-SPIN INTERACTIONS IN ISOTOPES OF THE HYDROGEN MOLECULE. Reid, R. V. Jr.; Vaida, M. L. (Univ. of California, Davis). Phys. Rev., A; 7: No. 6, 1841-1849(Jun 1973).

Field gradients were calculated at 12 values of the internuclear distance from 34-, 66-, and 87-term molecular wave functions expanded in prolate-spheroidal coordinates and $r_{12}$. Convergence of the gradients as the basis enlarges is indicated, and the dissociation energy of $H_2$ is in agreement with experiment. Using vibrationally averaged gradients, experimental values for the quadrupole-interaction constant, and estimating the error in the field gradients arising from truncation of the basis, the electric quadrupole moment of the deuteron is found to be $0.2875 \pm 0.002 \times 10^{-26}$ cm$^2$, which is 2% larger than the most recent values. This disagreement as well as that among earlier work is explained. First-order perturbation-theoretic results for the magnetic spin-spin interaction constant for $H_2(J = 1)$, $HD(J = 1)$, $D_2(J = 1)$, and $D_2(J = 2)$ are in agreement with experiment and, except for $H_2$, well inside experimental error. (auth)

**1340** FLOW OF A NONEQUILIBRIUM IONIZED GAS PAST A WALL IN THE PRESENCE OF A MAGNETIC FIELD. Kusukawa, K. I.; Takahashi, T. (Tokyo Metropolitan Univ.). pp 461-481 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921-.

Two-dimensional steady flow of a nonviscous compressible fluid in an applied magnetic field is theoretically studied. The flow past an insulated sinusoidal wall and then past sharp corners was analyzed. (MOW)

**1341** X-RAY ISOTOPE SHIFTS AND VARIATIONS OF NUCLEAR CHARGE RADII IN ISOTOPES OF Nd, Sm, Dy, Yb, AND Pb. Lee, P.L.; Boehm, F. (California Institute of Technology, Pasadena, California 91109). Phys. Rev. C 8: No. 2, 819-828 (Aug 1973).

Isotope shifts of electronic $K_{\alpha}$ x-ray transitions have been measured in isotopes of Nd, Sm, Dy, Yb, and Pb using a curved crystal spectrometer. The $\delta\langle r^2\rangle$ values of the nuclear charge distribution, as derived from the data, are presented. A combination with results from optical isotope shifts yields an improved accuracy for $\delta\langle r^2\rangle$. The optical mass shifts and the electronic coefficients can also be obtained. A comparison with muonic x-ray isotope shifts is presented for Nd and Pb. Consistency between electronic and muonic data is noted. (auth)

## Positronium, Muonium, and Muonic and Mesic Atoms and Molecules

*Refer also to abstract 1717.*

## Collision Phenomena

**1342** (LA-5280) POLYNOMIAL SOLUTIONS OF THE SCHROEDINGER EQUATION APPLIED TO PHOTON CROSS SECTIONS IN ATOMS. Merts, A. L.; Matuska, W. Jr. (Los Alamos Scientific Lab., N. Mex.). Aug 1973. Contract W-7405-eng-36. 45p. Dep. NTIS $4.00.

Solutions of the Schrödinger equation with a realistic potential are carried out in detail. To check the methods, a few bound-bound, bound-free, and free-free cross sections were calculated and values compared with existing calculations and experimental data. These comparisons, along with a listing of the computer code in its bound-free form, are included. (auth)

**1343** SPATIAL DISTRIBUTION OF IONS SCATTERED BY CRYSTALS. Labzin, V. G.; Skripka, Yu. G. (Donetsk State Univ., USSR). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 8, 1246-1248 (Aug 1973). (In Russian).

Spatial and energy distributions of ions scattered by copper crystals are studied. The results of the experiment are interpreted within the framework of multiple ion collisions with solids. (auth)

**1344** DOPPLER BROADENING EFFECT ON COLLISION CROSS SECTION FUNCTIONS. Deconvolution of the Thermal Averaging. Bernstein, R. B. (Univ. of Wisconsin, Madison). Comments At. Mol. Phys.; 4: No. 2, 43-51(Mar 1973).

The increasing interest in types of energetic heavy particle collision experiments is referred to, and particularly experiments on collisional excitation and ionization, collision induced dissociation, and endoergic ion-neutral charge transfer, the aim being to determine threshold energies $E_0$ and threshold "laws" for the cross section $\sigma(E)$. The threshold is an upper bound on the thermodynamic energy defect ($\Delta E_0$) for the process, which is of basic importance as it characterizes the overall energetics of the reaction. The threshold "law" is of theoretical interest from the point of view of the molecular dynamics of the reaction, and it is also of practical concern, since a knowledge of the post threshold energy dependences $\sigma(E-E_0)$ greatly facilitates the experimental determination of $E_0$. The principal matters discussed in this communication are concerned with Doppler effects, including the Doppler effect on threshold behaviour and Doppler broadening effects on thermal energy beam experiments. (UK)

**1345** ABSOLUTE EXCITATION CROSS SECTIONS OF THALLIUM ATOMS FOR ELECTRON IMPACT. Zapesochnyi, I. P.; Shimon, L. L.; Neplypov, E. I. (Vzhgorod State Univ., USSR). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 8, 1301-1306(Aug 1973). (In Russian).

Absolute cross sections for exciting spectral lines of main sharp and diffuse series are studied by means of the method of a steam-filled cell and the method of crossing atomic and electronic beams. An exponential dependence of the excitation cross sections on the principal quantum number of the initial levels is established for the lines of the main and diffuse series. Deviation from the monotonous decrease in the cross section values with transition to higher terms of the series is observed within the limits of the sharp series. This anomaly is explained by the effect of mixing corresponding levels. It is established that the contribution of cascade transitions to population of $n^2P_{1/2,3/2}$-levels is not large, i.e., the excitation cross sections of the main series spectral lines differ slightly from the excitation cross sections of the initial $n^2P_{1/2,3/2}$-levels. The excitation cross section of the most efficiently excited resonance $7^2S_{1/2}$-level is estimated, its value ($4.4 \cdot 10^{16}$ cm$^2$) is close to the maximum value calculated by the Bethe approximate formula. The cascade population of the higher $n^2S_{1/2}$-levels is considerable. This circumstance is supposed to determine different form of the resonance lines' excitation functions and of higher terms with initial $n^2S_{1/2}$-levels. (auth)

**1346** IMPACT-PARAMETER DEPENDENCE OF THE PROBABILITY FOR COPPER K-SHELL IONIZATION BY OXYGEN PROJECTILES. Cocke, C.L.; Randall, R. (Physics Department and Nuclear Science Laboratory, Kansas State University, Manhattan, Kansas, 66506). Phys. Rev. Lett. 30: No. 21, 1016-1019 (21 May 1973).

The experimental impact-parameter dependence of the probability for copper K-shell ionization by oxygen projectiles with energies between 25 and 43 MeV is presented. The shape of the experimental curve at 43 MeV is found to be quite similar to one calculated in the semiclassical Coulomb approximation. (auth)

**1347** EXCITATION OF THE He($2^1$S and $2^1$P) STATES BY 15-100-keV $Li^+$ BOMBARDMENT. Park, J.T.; Pol, V.; Lawler, J.; George, J. (Physics Department, University of Missouri-Rolla, Rolla, Missouri, 65401). Phys. Rev. Lett. 30: No. 21, 1013-1015 (21 May 1973).

Excitation of the He($2^1$S) state by 15-100-keV $Li^+$ bombardment has been studied as a function of the angular scattering of $Li^+$. The ratio of He($2^1$S) to He($2^1$P) excitations is about 0.6 and appears to be independent of both $Li^+$ energy and scattering angle. Excitation of the He($2^1$S) state indicates an inability of correlation diagrams based on the electron promotion model to predict all of the excitation products for $Li^+$+He collisions in this energy range. (auth)

**1348** ENERGY TRANSFER IN COLLISIONS OF FAST ATOMS OR IONS. Makarkin, B.D. (A. A. Zhdanov Leningrad State University). Sov. Phys.-Tech. Phys. 17: No. 11, 1799-1801 (May 1973).

The classical approximation is used to calculate the cross section for scattering with a given momentum transfer in collisions of two fast atoms that interact through the Coulomb potential as shielded by a Thomas-Fermi function. The results are applied to the dissociation of a diatomic molecule by collision with fast atoms or ions. (auth)

**1349** ELASTIC SCATTERING OF POTASSIUM IONS IN ARGON. Chigin', V.I.; Palyukh, B.M.; Savchin, L.S. (Ivan Franko L'vov State University). Sov. Phys.-Tech. Phys. 17: No. 10, 1709-1712 (Apr 1973).

The total cross section for elastic collisions of potassium ions on argon is investigated by the minimum scattering-angle method in the ion energy range from 1 to 200 eV. The angle is varied from 1° to 16°. From the relation found between Q and E we find the shape of the interaction potential in the attraction region (5.2-2.1 Å) to be $U=-16/r^4$ eV. A preliminary estimate of the potential in the repulsion region is found to be in agreement with results of other experimental investigations. The boundary of the polarization region is $E\theta_0 = 4$ eV · rad. (auth)

**1350** CHARGE-STATE DEPENDENCE OF THE ARGON L-SHELL FLUORESCENCE YIELD STUDIED BY $H^+$, $H_2^+$, AND $He^+$ IMPACT. Stolterfoht, N. (Abteilung Strahlenphysik, Hahn-Meitner-Institut für Kernforschung Berlin GmbH, Berlin-West, Germany); de Heer, F.J.; van Eck, J. Phys. Rev. Lett. 30: No. 23, 1159-1162 (4 June 1973).

The fluorescence yield was determined for the Ar L shell by measuring absolute cross sections for Ar L x-ray and Auger-electron emission for 30- to 600-keV $H^+$, $H_2^+$, and $He^+$ ions on Ar. When the Auger-electron spectrum was analyzed, the fluorescence yield for $He^+$ was found to be an order of magnitude larger than existing theoretical estimates. (auth)

# PHYSICS (ELECTROFLUID AND MAGNETOFLUID)

*Refer also to abstract 1792.*

**1351** SOME ELECTROGASDYNAMIC FLOWS WITH CURVED STREAMLINES. Broadbent, E. G. (Royal Aircraft Establishment, Farnborough, Eng.). pp 483-507 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921--.

One of the difficulties of achieving appreciable power conversion by means of electrogasdynamics is the tendency for the electric field to become locally large (and hence to cause gas breakdown) in view of the fact that its divergence is determined by the charge density. A curving flow field, however, along the lines of a Prandtl-Meyer expansion, can, if suitably chosen, accommodate the divergence without involving excessive fields. Such flows seem particularly suited to accelerators and can be adapted to include charge neutralization of the beam; and in a special case, it is theoretically possible to accelerate a flow at constant pressure, temperature and density, e.g., a liquid. Some numerical examples are given. (auth)

**1352** NONSTATIONARY PLASMA FLOWS BEHIND A MOVING FRONT. Mareev, V. A. Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza; No. 4, 156-162(1973). (In Russian).

A study is made on the nonstationary movement of a conducting, optically transparent gas separated from a rarified medium at rest by a front S that passes through a zone of a nonhomogeneous magnetic field. Limiting conditions are imposed on S for a number of interaction mechanisms of S with the rarified medium. Solutions were obtained by a linear approximation. Solutions of the general set of equations were found by means of numerical methods. The very nonmonotonic character for the movement of S in a inhomogeneous magnetic field was established. (SJR)

**1353** PROCESS FOR MAGNETOHYDRODYNAMICAL TRANSFORMATION OF THE MECHANICAL ENERGY OF MOVING LIQUIDS INTO MAGNETIC ENERGY. Steenbeck, M.; Krause, F. (to Deutsche Akademie der Wissenschaften). German Patent 1,906,355. 23 Dec 1970. Filed Date 8 Feb 1969. (In German).

The alpha effect is utilized in MHD energy conversion. (EJH)

**1354** MAGNETOHYDRODYNAMIC LAMINAR FLOW ALONG A VERTICAL WALL. Agrawal, H. L.; Ram, P. C. (Banaras Hindu Univ., India). Indian J. Phys.; 47: No. 6, 364-370(Jun 1973).

The problem of magnetohydrodynamic laminar flow of an electrically conducting fluid along a vertical wall under the influence of gravity and in presence of transverse magnetic field is studied. The effect of transverse magnetic field on the boundary layer thickness and on the film thickness from a vertical wall is considered when surface tension is neglected. (auth)

**1355** TRANSIENT MAGNETOHYDRODYNAMIC EFFECTS IN BOUNDED ELECTROLYTES. I. Gak, M. Z.; Gak, E. Z. Sov. Phys. Tech. Phys. (Engl. Transl.); 17: No. 9, 1595-1596(Mar 1973).

Translated from Zh. Tekh. Fiz.; 42: No. 9, 1992-1994(Sep 1972).

The excitation of capillary gravitational waves in an electrolyte is considered; these waves are excited by magnetohydrodynamic oscillations in a bounded rectangular open channel. Experiments on the excitation of standing capillary gravitational waves are discussed. The wavelength is determined by the frequency of the ac current conducted into the channel and by the surface tension, while the amplitude is determined by the current, the magnetic field, and the geometric parameters of the channel. (MHR)

**1356** GROWTH OF PRESSURE SHOCKS IN RADIATIVE MAGNETOGASDYNAMICS. Ojha, S. N.; Verma, B. G. (Gorakhpur Univ., India). Pure Appl. Geophys.; 102: No. 1, 148-152(1973).

The growth equation for the pressure shocks as conceived by Thomas and Edstrom (1961), in a thermally and electrically conducting viscous gas has been derived. Ionization and dissociation have not been taken into account, while the effects of radiation have been considered under the assumption that the radiative parameters are independent of magnetic field. During the course of derivation certain boundary conditions and the well-known compatibility conditions established by Thomas (1957) have been used. (auth)

**1357** MODEL OF TWO DIMENSIONAL MAGNETOHYDRODYNAMIC FLOW. Mitra, A. K. (Texas Tech, Univ., Lubbock). Acta Phys. Pol.; A44: No. 2, 165-171(Aug 1972).

A model of a two-dimensional magnetohydrodynamic compressible flow of a perfectly conducting inviscid fluid in the absence of an external field is studied. The magnetic field has been taken in an arbitrary direction. In this case the density becomes a function of $\varphi$, the z-component of the vector potential. The stream function $\psi$ then satisfies a parabolic differential equation and the model is particularly simple when $\varphi$ is known. (auth)

# PHYSICS (HIGH-ENERGY)

## Particle Interactions and Properties (Experimental)

*Refer also to abstract 911.*

### Electromagnetic

*Refer also to abstract 1339.*

**1358** INCLUSIVE $\pi^\pm$, $\rho^0$ AND $\Delta^{++}$ REACTIONS PHOTOPRODUCED ON NEUTRONS AND PROTONS AT 7.5 GeV. Gandsman, J.; Alexander, G.; Dagan, S.; Jacobs, L. D.; Levy, A.; Lissauer, D.; Rosenstein, L. M. (Tel-Aviv Univ., Israel). Nucl. Phys., B61: 32-44(1973).

A comparison between the reactions $\gamma p \rightarrow \pi^\pm$ + anything and $\gamma n \rightarrow \pi^\pm$ + anything was carried out with a linearly polarized photon beam of 7.5 GeV incident energy. The data were analysed in terms of the structure functions F(x), $F(P_{||})$ and $F(P_\perp^2)$. The reaction $\gamma N \rightarrow \rho^0$ + anything was investigated and found to have similar behavior as leading particles in hadron induced reactions as expected from the vector dominance model. Finally the reaction $\gamma p \rightarrow \Delta^{++}$ + anything was found to exhibit backward leading particle features and to be consistent with a one pion exchange mechanism. (auth)

**1359** PHOTOPRODUCTION OF POSITIVE PIONS AT 180° AT PHOTON ENERGIES FROM 0.4 TO 1.4 GeV. Dannhausen, H. W.; Fischer, G.; Fischer, H. M.; Kircher, K.; Leneke, M.; Niehaus, W.; Wessels, H. (Univ., Bonn). Nucl. Phys., B61: 285-295(1973).

Pions from the reaction $\gamma + p \rightarrow \pi^+ + n$ were analysed in the backward direction by a magnetic spectrometer. The photon energy region of 0.394 GeV to 1.397 GeV was covered by 19 different momentum settings. Data reduction resulted in 74 measured differential cross sections with statistical uncertainties typically from 4% to 8%. The systematic uncertainty was estimated to be ±5%. The data are compared to other recent experiments and predictions of phenomenological analyses. (auth)

**1360** COMPARISONS OF DEEP-INELASTIC e-p AND e-n CROSS SECTIONS. Bodek, A.; Breidenbach, M.; Dubin, D.L.; Elias, J.E.; Friedman, J.I.; Kendall, H.W.; Poucher, J.S.; Riordan, E.M.; Sogard, M.R. (Physics Department and Laboratory for Nuclear Science, Massachusetts Institute of Technology, Cambridge, Massachusetts, 02139); Coward, D.H. Phys. Rev. Lett. 30: No. 21, 1087-1091 (21 May 1973).

Cross sections for inelastic scattering of electrons from hydrogen and deuterium were measured for incident energies from 4.5 to 18 GeV, at scattering angles of 18°, 26°, and 34°, and covering a range of squared four-momentum transfers up to 20 $(GeV/c)^2$. Neutron cross sections were extracted from the deuterium data using an impulse approximation. Comparisons with the proton measurements show significant differences between the neutron and proton cross sections. (auth)

**1361** BACKWARD PHOTOPRODUCTION OF NEUTRAL PIONS OFF HYDROGEN AT PHOTON ENERGIES BETWEEN 0.4 AND 2.2 GeV. Becks, H.; Feller, P.; Menze, D.; Opara, U.; Schulz, W.; Schwille, W. J. (Univ., Bonn). Nucl. Phys., B60: No. 1, 267-276(1973).

The differential cross section was measured for the reaction $\gamma + p \rightarrow p + \pi^0$ at the Bonn 2.5 GeV electron synchrotron in the energy range from 0.4 to 2.2 GeV for a c.m. angle of 150 degrees. The protons were detected in a magnetic spectrometer system. The excitation curve shows a distinct resonance structure. The total corrections to the counting rate are about 3%. The contribution of the process $\gamma + p \rightarrow p + 2\pi$ was separated. The uncertainty of this separation leads to an error of about 4% in the cross section. (auth)

**1362** MEASUREMENTS OF INELASTIC ELECTRON SCATTERING CROSS SECTIONS NEAR THE ONE-PION THRESHOLD. Bloom, E.D.; Cottrell, R.L.A.; DeStaebler, H.; Jordan, C.L.; Piel, H.G.; Prescott, C.Y.; Siemann, R.; Stein, S.; Taylor, R.E. (Stanford Linear Accelerator Center, Stanford University, Stanford, California, 94305). Phys. Rev. Lett. 30: No. 23, 1186-1189 (4 June 1973).

The cross sections for single-arm inelastic electron-proton scattering were measured near the one-pion threshold for six values of $q^2$ between 0.23 and 1.84 $GeV^2$. We determined the cross sections for nonresonant pion production and, using a particular formulation of soft-pion theory, extracted the normalized axial-vector form factor of the nucleon, $G_A(q^2)/G_A(0)$. (auth)

**1363** HADRON PRODUCTION BY ELECTRON-POSITRON ANNIHILATION AT 4-GeV CENTER-OF-MASS ENERGY. Litke, A.; Hanson, G.; Hofmann, A.; Koch, J.; Law, L.; Law, M.E.; Leong, J.; Little, R.; Madaras, R.; Newman, H.; Paterson, J.M.; Pordes, R.; Strauch, K.; Tarnopolsky, G.; Wilson, R. (Harvard University, Cambridge, Massachusetts, 02138). Phys. Rev. Lett. 30: No. 23, 1189-1192 (4 June 1973).

We have measured the total cross section for electron-positron annihilation into three or more hadrons, with at least two charged particles in the final state. The measurement was made at a center-of-mass energy of 4 GeV with a $2\pi$-sr nonmagnetic detector. With 88 events detected, we obtain a model-independent lower limit on the hadron production cross section of $9.6 \pm 1.4$ nb; a calculation of detection efficiency based on invariant phase-space production of pions leads to a total cross section of $26 \pm 6$ nb. This cross section is $4.7 \pm 1.1$ times the theoretical total cross section for $e^+e^- \rightarrow \mu^+\mu^-$. The average charged multiplicity is $\bar{n} = 4.2 \pm 0.6$. (auth)

**1364** ASYMMETRIES IN CHARGED-PION PHOTOPRODUCTION ON NUCLEONS BY 16-GeV POLARIZED PHOTONS. Sherden, D.J.; Siemann, R.H.; Sinclair, C.K. (Stanford Linear Accelerator Center, Stanford University, Stanford, California, 94305); Quinn, D.J.; Rutherfoord, J.P.; Shupe, M.A. Phys. Rev. Lett. 30: No. 24, 1230-1234 (11 June 1973).

Asymmetries in charged-pion photoproduction from hydrogen and deuterium have been measured with 16-GeV linearly polarized photons. Considerable energy dependence is seen in the natural-parity contribution to the $\pi^-/\pi^+$ ratio from deuterium, and in the unnatural-parity part of the cross section for $\gamma n \rightarrow \pi^- p$. The energy dependence of this latter cross section is consistent with the expected from a conventional pion Regge trajectory. (auth)

### Weak

**1365** (IFVE-SEF-72-116) SEARCH FOR HEAVY QUASI-STABLE LEPTONS. Bushnin, Yu. B.; Golovkin, S. V.; Dunaitsev, A. F.; Zaitsev, A. M.; Kubarovskii, V. P.; Landsberg, L. G.; Leont'ev, V. M.; Petrunina, T. I.; Sen'ko, V. A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1972. 30p. (In Russian). Dep. NTIS (U. S. Sales Only) $3.50.

Negative results of a search for heavy quasistable charged leptons at the IHEP accelerator are reported. For the selection of heavy leptons a system of scintillation and gas Cherenkov counters was used. The upper limit estimation of the differential cross sections for heavy lepton production in p-N collisions at $E_p = 70$ GeV is, for example, $(d^2\sigma_\lambda/dpd\Omega)$ (p = 30 GeV/c; $\theta = 2$ mrad, $1 \leq M_\lambda \leq 4.8$ GeV) 90% = $4.10^{-38} cm^2/ster \cdot GeV$). The results, together with the data on muon pair production in nucleon-nucleon interactions, show that there are no heavy charged leptons with masses from 0.55 GeV ($\tau_\lambda > 7.10^{-10}$ sec) up to 4.5 GeV ($\tau_\lambda > 3.10^{-8}$ sec). (auth)

**1366** EARLY OBSERVATION OF NEUTRINO AND ANTINEUTRINO EVENTS AT HIGH ENERGIES. Benvenuti, A.; Cheng, D.; Cline, D.; Ford, W.T.; Imlay, R.; Ling, T.Y.; Mann, A.K.; Messing, F.; Pilcher, J.; Reeder, D.D.; Rubbia, C.; Sulak, L. (Department of Physics, Harvard University, Cambridge, Massachusetts, 02138). Phys. Rev. Lett. 30: No. 21, 1084-1087 (21 May 1973).

Presented here are preliminary results of two short runs with a broad-band neutrino-antineutrino beam at National Accelerator Laboratory incident on about 120 tons of target which is part of a detector consisting of an ionization calorimeter and a muon magnetic spectrometer. These results include (i) the observed distribution in transverse muon monentum, $dN/dp_\mu$, (ii) the average neutrino cross section at a mean neutrino energy of roughly 30 GeV, and (iii) the ratio of the antineutrino to the neutrino total cross section at a mean neutrino energy of 40 GeV. (auth)

### Strong (Baryon-induced)

*Refer also to abstract 1108.*

**1367** (COO-1112-170) VERY HIGH ENERGY PROTON PROTON SCATTERING. Krisch, A. D. (Michigan Univ., Ann Arbor. Harrison M. Randall Lab. of Physics). 1972. 72p. (UM-HE-72-24). Dep. NTIS $5.75.

A lecture on experimental techniques at the CERN ISR and the current data and phenomenology of proton-proton scattering is given. (JFP)

**1368** (COO-1545-131) FLUID ANALOG IN HIGH ENERGY COLLISIONS. Tanaka, K.; Ueda, Y. (Goteborg Univ. (Sweden). Inst. of Theoretical Physics; Ohio State Univ., Columbus. Dept. of Physics; Goteborg Univ. (Sweden). Inst. of Theoretical Physics). 1973. Contract AT(11-1)-1545. 24p. Dep. NTIS $3.25.

The generating functions which represent the p p data from 50 to 303 GeV/c are used as analog grand partition functions and notions of analog pressure, specific volume, equation of state and critical point are explored. Also l-plane singularities are dicussed in this connection. (auth)

**1369** (INP-842) MULTIPLICITY DISTRIBUTIONS IN PROTON-NUCLEUS COLLISIONS AT 67 AND 200 GeV. Babecki, J.; Czachowska, Z.; Furmanska, B.; Gierula, J.; Holynski, R.; Jurak, A.; Krzywdzinski, S.; Nowak, G.; Slezak, B.; Wolter, W. (Institute of Nuclear Physics, Krakow (Poland)). Jul 1973. 13p. Dep. NTIS (U. S. Sales Only) $3.00.

New data concerning multiplicities in collisions of 67 and 200 GeV protons in emulsion are presented. Various parameters of multiplicity distributions in collisions of protons with nuclei of photographic emulsion at primary energies between a few and about 1000 GeV are compared with p-p collisions. (auth)

**1370** NEUTRON–PROTON ELASTIC SCATTERING FROM 10 TO 24 GeV/c. Engler, J.; Flauger, W.; Gibbard, B.; Moennig, F.; Pack, K.; Runge, K.; Schopper, H. (CERN, Geneva). Nucl. Phys., B62: 160-172(1973).

The neutron–proton elastic differential cross section was measured with high statistics for incident momenta between 10 and 24 GeV/c using wire spark chambers for the neutron detection. The t-range covered by previous experiments could thus be extended to 0.06 – 3 $(\mathrm{GeV/c})^2$. In this t-interval the np cross section is found to be very similar to the corresponding pp cross section. (auth)

**1371** ABSORPTION CROSS SECTIONS FOR PIONS, KAONS, PROTONS, AND ANTIPROTONS ON COMPLEX NUCLEI IN THE 6 TO 60 GeV/c MOMENTUM RANGE. Denisov, S. P.; Donskov, S. V.; Gorin, Yu. P.; Krasnokutskii, R. N.; Petrukhin, A. I.; Prokoshkin, Yu. D.; Stoyanova, D. A. (Inst. for High Energy Physics, Serpukhov, USSR). Nucl. Phys., B61: 62-76(1973).

Absorption cross sections for $\pi^\pm$, $K^\pm$ mesons, protons and antiprotons on Li, Be, C, Al, Cu, Sn, Pb and U in the momentum range from 6.65 to 60 GeV/c are measured at the 70 GeV IHEP accelerator. The cross sections are compared with calculations using the Glauber multiple-scattering model. Nucleus radii are found to be described by a power dependence on atomic weight $R = r_0 A^{1/3}$, where $r_0 = 1.05 \pm 0.02$ fm. (auth)

**1372** GENERAL CHARACTERISTICS OF THE ANNIHILATION REACTION $\bar{p}p \to 2\pi^+2\pi^-(\pi^0)$ AT 3.6 GeV/c. Debray, J.; Laberrigue-Frolow, J.; de la Vaissiere, C.; Yiou, T. P. (LPNHE, Paris). Nucl. Phys., B62: 13-45(1973).

About 43,000 four prong events of antiproton-proton interactions at 3.6 GeV/c were analysed in order to investigate pion annihilation. The cross sections of different channels are determined. Resonance production (including associated resonances) in $4\pi$ and $5\pi$ final states is analysed in detail. More than one resonance per event is produced. Associated resonance production is important (25% of the cases). Angular and momentum distributions of single pions and those of resonances are given. The influence of resonance production is analysed. Peripheral character appears in particular in two body ($\rho^0f^0, f^0f^0, \rho^0g^0, f^0g^0, \omega^0f^0$) and three body ($\rho^\pm\rho^0\pi^\mp$) annihilations. (auth)

**1373** FIVE PION FINAL STATE IN THE T-REGION. Donald, R. A. (Univ. of Liverpool); Edwards, D. N.; Gibbins, J. K.; Briand, H.; Duboc, J.; Levy, F. Nucl. Phys., B61: 333-350(1973).

53,640 $5\pi$ events from antiproton annihilations in hydrogen were analysed; the c.m. energies cover the range 2.10 – 2.24 GeV and span the T-region. Detailed analysis of the resonance production, with particular reference to a direct s-channel effect, was carried out. An earlier reported effect in the final state $\rho^0\rho^0\pi^0$ is not confirmed. Some evidence is found for a narrow structure of mass 2.141 GeV/c$^2$ and width 14 MeV/c$^2$ in the final state $\omega^0\pi^+\pi^-$. (auth)

**1374** OBSERVATIONS ON $\bar{p}$-d ANNIHILATIONS AT REST INTO TWO PIONS. Gray, L.; Papadopoulou, T.; Simopoulou, E.; Vayaki, A. (Nuclear Research Center Democritos, Aghia Paraskevi Attikis, Athens, Greece); Kalogeropoulos, T.; Roy, J. Phys. Rev. Lett. 30: No. 21, 1091-1094 (21 May 1973).

The ratio $(\bar{p}d \to \pi^-\pi^0 p_s)/(\bar{p}d \to \pi^-\pi^+ n)$ at rest, with spectator momenta $\lesssim$ 300 MeV/c, has been measured and found to be 0.68±0.07. This implies that (75 ± 8)% of the annihilations in deuterium into two pions come from odd $\bar{N}N$ orbital angular momenta, in disagreement with the S-state-dominance hypothesis. It has also been observed that the $\bar{p}d \to \pi\pi^0 p_s$ production rate depends on the spectator momentum, which suggests energy-sensitive $\bar{N}N$ phenomena near threshold. (auth)

**1375** ELASTIC SCATTERING AND TWO-BODY ANNIHILATIONS AT 5 GeV/c. Eide, A. (Cern, Geneva); Lehmann, P.; Lundby, A.; Baglin, C.; Briandet, P.; Fleury, P.; Carlson, P. J.; Johansson, E.; Davier, M.; Gracco, V.; Morand, R.; Treille, D. Nucl. Phys., B60: No. 1, 173-220(1973).

Results are presented of measurements of $K^\pm p$ and $\bar{p}p$ elastic scattering and of the annihilation reactions $\bar{p}p \to \pi^+\pi^-$ and $\bar{p}p \to K^+K^-$ at an incident laboratory momentum of 5 GeV/c. Nearly complete angular distributions were obtained. Results are also presented for $\pi$-meson proton elastic scattering in the momentum transfer ranges $2 < -t < 8$ $(\mathrm{GeV/c})^2$ (for $\pi^+$) and $0.16 < -t < 7$ $(\mathrm{GeV/c})^2$ (for $\pi^-$). All measurements were done in one experimental geometry. The measured differential cross sections range from 10 to $10^{-6}$ mb/$(\mathrm{GeV/c})^2$. For the first time, backward peaks have been observed in $K^-p$ and $\bar{p}p$ elastic scattering. In $K^+p$ elastic scattering the forward peak shows a break at $-t \approx 0.8$ $(\mathrm{GeV/c})^2$ and the backward peak shows a structure at $-u \approx 1.2$ $(\mathrm{GeV/c})^2$. Large angle $\pi p$ scattering oscillates around an average differential cross section of 0.1 $\mu$b/$(\mathrm{GeV/c})^2$. In addition to the well-known dip at $-t \approx 3$ $(\mathrm{GeV/c})^2$, further dips were observed at $-t \approx 4.6$ and 5.7 $(\mathrm{GeV/c})^2$. The annihilation reactions show both forward and backward peaks. (auth)

**1376** MESON RESONANCE PRODUCTION IN THE REACTION $p + d \to {}^3\mathrm{He} +$ MESON. Schluter, R. A. (Argonne National Lab., IL); Patel, P. M.; Rippich, C.; Ryan, D. G.; Sannes, F.; Stairs, D. G.; Trischuk, J. M.; Brody, H. Nucl. Phys., B60: No. 1, 396-410(1973).

The production of neutral, non-strange mesons was measured in the reaction $p + d \to {}^3\mathrm{He}$ + missing mass at an incident momentum of 5.0 GeV/c. The mass range of 500 to 870 MeV/c$^2$ was covered. The production cross sections for $\eta$, $\rho^0$ and $\omega$ production are 24.0 ± 2.8, 52.5 ± 10.0 and 11.6 ± 2.2 pb/sr respectively, in the c.m. frame, at a four-momentum transfer of approximately 2 $(\mathrm{GeV/c})^2$. (auth)

**1377** MEASUREMENT OF THE POLARIZATION PARAMETER IN NP CHARGE-EXCHANGE SCATTERING FROM 2 to 12 GeV/c. Abolins, M.A.; Lin, M.T.; Ruchti, R.C. (Department of Physics, Michigan State University, East Lansing, Michigan, 48823); Horowitz, J.G.; Kammerud, R.C.; Reay, N.W.; Reibel, K.; Stanton, N. R.; Edwards, K. W.; Crabb, D. G.; O'Fallon, J. R. Phys. Rev. Lett. 30: No. 23, 1183-1185 (4 June 1973).

We have measured the polarization parameter in neutron–proton charge–exchange scattering for incident neutron momenta of 2–12 GeV/c and $0.1 \leq |t| \leq 1.0$ $(\mathrm{GeV/c})^2$. Results based on 300 000 events show a negative polarization whose magnitude increases monotonically with $|t|$ approaching 60% for $|t| \sim 0.6$ and which has little energy dependence. (auth)

**1378** pp INTERACTIONS AT 303 GeV/c: INCLUSIVE STUDIES OF $\gamma$, $K_s^0$, AND $\Lambda^0$ PRODUCTION. Dao, F. T.; Gordon, D.; Lach, J.; Malamud, E.; Schivell, J. (National Accelerator Laboratory, Batavia, Illinois, 60510); Meyer, T.; Poster, R.; Schlein, P.E.; Slater, W.E. Phys. Rev. Lett. 30: No. 22, 1151-1154 (28 May 1973).

From analysis of $V^0$ events observed in an exposure of the National Accelerator Laboratory 30–in. bubble chamber to 303–GeV/c protons, we obtain these results: (1) $\langle n_{\pi^0} \rangle$ rises approximately linearly with $n_-$, implying strong coupling of neutral and charged pions, while $< n_{K_S^0} >$ is less coupled to n; (2) $\gamma$, $K_S{}^0$, and $\Lambda^0$ production cross sections are approaching a scaling limit by 303 GeV/c; (3) within the limited statistics, $d\sigma/dy$ is flat in the central region for $K_s{}^0$ and low–multiplicity $\gamma$ events. (auth)

**1379** $\Sigma^-$ PRODUCTION IN HIGH–ENERGY PROTON INTERACTIONS. Hungerbuehler, V.; Majka, R.; Marx, J.N.; Némethy, P.; Sandweiss, J.; Tanenbaum, W.; Willis, W.J. (Yale University, New Haven, Connecticut, 06520); Atac, M.; Ecklund, S.; Gollon, P.J.; Lach, J.; MacLachlan, J.; Roberts, A.; Stefanski, R.; Theriot, D.; Wang, C.L. Phys. Rev. Lett. 30: No. 24, 1234-1237 (11 June 1973).

Momentum spectra for forward $\Sigma^-$ production on beryllium by protons of momentum 25.8 and 29.4 GeV/c are presented. Data for the two primary proton momenta are compared for scaling behavior in the invariant cross section. In addition, the observed single–particle momentum distributions are compared with single–particle spectra from other inclusive reactions initiated by protons. (auth)

## *Strong (Meson-induced)*

**1380** (COO-2009-60) TECHNICAL PROGRESS REPORT OF THE INDIANA UNIVERSITY SPARK CHAMBER GROUP, DECEMBER 1, 1972 – NOVEMBER 30, 1973. Brabson, B. B.; Crittenden, R. R.; Heinz, R. M.; Neal, H. A. (Indiana Univ., Bloomington). 1973. Contract AT(11-1)-2009. 10p. Dep. NTIS $3.00.

Experimental research on strong interactions is summarized. (JFP)

**1381** (IFVE-STF-72-110) TRIANGULAR SINGULARITY IN PARTIAL-WAVE ANALYSIS OF THREE MESON SYSTEM. Kobrinskii, M. N.; Likhoded, A. K. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1972. 24p. (In Russian). Dep. NTIS (U. S. Sales Only) $3.25.

Singular parts of triangular diagrams arising in $\pi + p \rightarrow 3\pi + p$ and $K + p \rightarrow K\,\pi\pi + p$ reactions as a result of particle rescattering in the final state are calculated in the framework of isobar model. Such singular contributions to total amplitudes of these reactions allow one to define scattering amplitude of unstable particles ($\pi\,\pi$ or $K\,\pi$) at small relative energies. (auth)

**1382** FORWARD PEAK IN $\pi^+p$ REACTIONS AT 8, 16, AND 23 GeV/c AND COMPARISON WITH ISR RESULTS. Aachen-Berlin Bonn-CERN-Krakow-Heidelberg-Warsaw Collaboration. Nucl. Phys., B62: 1-12(1973).

The forward peak in the longitudinal momentum distribution of $\pi^+$ is studied in $\pi^+p$ reactions at 8, 16 and 23 GeV/c. It is found that at these energies contributions to the forward peak come mainly from three- and four-body final states and are dominated by the "diffractive" processes. It is shown that the contribution of the diffractive processes to the forward peak at out energies has shape and magnitude similar to those observed in pp collisions at ISR energies. (auth)

**1383** $K^-p$ ELASTIC SCATTERING AT 3.59 GeV/c. Lowman, A. W.; McCubbin, N. A. (Nuclear Physics Lab., Oxford). Nucl. Phys., B61: 296-306(1973).

The $K^-p$ elastic-scattering differential cross sections were measured at 3.59 GeV/c for $t < -0.1\ (\mathrm{GeV}/c)^2$. After all geometrical and kinematical cuts we have 11,734 elastic events. The forward diffraction peak has a slope of $7.57 \pm 0.1\ (\mathrm{GeV}/c)^{-2}$, and there is a marked dip-bump structure at $t \sim -1.0\ (\mathrm{GeV}/c)^2$. The elastic cross section is $4.4 \pm 0.2$ mb. There is no evidence for a backward peak. (auth)

**1384** MEASUREMENTS OF $K^+p$ ELASTIC SCATTERING DIFFERENTIAL CROSS SECTIONS IN THE INCIDENT MOMENTUM RANGE 1368 TO 2259 MeV/c. Barber, P. C. (University Coll., London); Broome, T. A.; Busza, W.; Davies, J. K.; Duff, B. G.; Garbutt, D. A.; Heymann, F. F.; Imrie, D. C.; Lush, G. J.; Mgbenu, E. N.; Potter, K. M.; Ritson, D. M.; Robbins, L. A.; Rosner, R. A.; Sharrock, S. J.; Smith, A. D.; Hanna, R. C.; Pitts, P. R.; Sacharidis, E. J. Nucl. Phys., B61: 125-154(1973).

Measurements of complete angular distributions of elastic $K^+p$ scattering at closely spaced incident momenta from 1368 to 2259 MeV/c are presented and discussed. A PDP-8 computer controlled system of scintillation counters and core-readout wire spark chambers was used for the detection of elastic events. Diffractive behavior is already present at the lowest measured momentum and becomes more prominent as the incident momentum increases. An expansion of the angular distributions in terms of Legendre polynomials shows no marked structure of the expansion coefficients as functions of the incident momentum. The measurements can be adequately described by a number of existing phase shift solutions within 5% of their published values. Also Regge pole extrapolations represent our data satisfactorily. (auth)

**1385** CHARGE EXCHANGE AND CHARGE DISTRIBUTIONS IN $K^-p$ INTERACTIONS AT 10 AND 16 GeV/c. Acchen-Berlin-CERN-London-Vienna Collaboration. Nucl. Phys., B62: 46-60 (1973).

For each $K^-p$ event, the charge exchange, $\Delta Q$, is calculated, as the difference between the total charge of the forward going particles and of the incident K-meson. Taking all inelastic events, it is found that zero charge exchange does not dominate, occurring in only 40% of the cases. The proportion of $\Delta Q = +1$ is also 40%, while $\Delta Q = -1$ and $\Delta Q = +2$ both represent about 10% of the events and other values of $\Delta Q$ are not important. The average charge exchange and the dispersion of $\Delta Q$ values are compared with the predictions of the multiperipheral and fragmentation models. (auth)

**1386** $\Omega$-PRODUCTION IN $K^-p$ INTERACTIONS. Aachen-Berlin-CERN-London-Vienna Collaboration. Nucl. Phys., B61: 102-115(1973).

20 events of $\Omega^-$ production observed in $K^-p$ interactions at 10 GeV/c are reported. A summary of the present world sample is given and new average values of the mass and lifetime of the $\Omega^-$ are calculated. Production and decay characteristics are discussed. (auth)

**1387** $K^-d$ ELASTIC SCATTERING AT 727 MeV/c. Wieckowicz, R. P.; Albright, J. R.; Lannutti, J. E. (Florida State Univ., Tallahassee). Nucl. Phys., B61: 274-284(1973).

The differential cross section was measured using 940 events from the BNL 30-inch deuterium bubble chamber. Events were selected without regard to length of the deuteron, and so wide-angle scatters are included. The data are fitted well by a Glauber model with reasonable assumptions about the parameters. (auth)

**1388** ANALYSIS OF THE REACTION $\pi^-p \rightarrow p\omega\pi^-$ AT 9.1 GeV/c. Armenise, N. (Univ., Bari, Italy); Fogli Muciaccia, M. T.; Silvestri, A.; Forino, A.; Gessaroli, R.; Lendinara, L.; Quareni Vignudelli, A.; Cartacci, A. M.; Dagliana, M. G.; di Caporiacco, G.; Parrini, G. Nuovo Cim.; 17A: No. 4, 707-720 (21 Oct 1973).

The reaction $\pi^-p \rightarrow p\omega\pi^-$ was studied at 9.1 GeV/c, its total cross section is $\sigma = (123 \pm 22)\ \mu b$. The $pB^-$ and the quasi-three-body channels contribute with cross sections of $\sigma = (24 \pm 7)\ \mu b$. and $\sigma = (94 \pm 23)\ \mu b$, respectively. The main features of the quasi-three-body $p\omega\pi^-$ channel, displayed by some techniques of data presentation, are satisfactorily described by a double-Regge-pole model. In this model pomeron-meson and meson-meson exchanges are taken into account. An OPE model à la Veneziano predicts a total cross section too high and reproduces very poorly the observed features. (auth)

**1389** FOUR- AND FIVE-BODY $K^+p$ INTERACTIONS AT 2.11, 2.31, 2.53, AND 2.72 GeV/c. Lewis, P. H. (Westfield Coll., London); Allen, J. E.; Jacobs, N. J. D.; Danysz, J. A.; Islam, A. K. M. A.; Miller, D. B.; Penney, P. K.; Stewart, B. C.; Thompson, G.; Borg, A.; Brunet, J. M.; Narjoux, J. L. Nucl. Phys., B60: No. 1, 283-306(1973).

$K^+p$ interactions with production of 2 or 3 pions were studied at 2.11, 2.31, 2.53 and 2.72 GeV/c incident $K^+$ momenta. The cross sections are given for different reaction channels and for the production of resonances: $K^*(892)$, $\Delta(1231)$, $\eta^0$, $\omega^0$ and $\rho$. An analysis of the enchancement in the $K\pi\pi$ mass distributions around 1.26 GeV shows that at least a part of this enhancement is due to non-diffractive production of a resonance Q with mass $M = 1.260$ GeV and width $\Gamma = 0.047$ GeV. A study of the production and decay angular distributions of $\Delta^{++}$ and $K^{*0} \rightarrow K^+\pi^-$ indicates that the reaction $K^+p \rightarrow K^*\Delta$ is dominated by pion exchange but this mechanism is not suffieient to obtain a good description of the data. A dependence of the shape of $\Delta^{++}$ on the momentum transfer is observed. (auth)

**1390** MOMENTUM DISTRIBUTIONS OF PARTICLES PRODUCED IN $K^-p$ INTERACTIONS AT 10 AND 16 GeV/c. Aachen-Berlin-Cern-London (IC)-Vienna Collaboration. Nucl. Phys., B60: No. 1, 307-314(1973).

The momentum distributions of particles produced in $K^-p$ interactions at 10 and 16 GeV/c are studied. In particular the average transverse momentum is presented as a function of the reduced longitudinal momentum for six different secondary particles, namely: $\pi^+$, $\pi^-$, $K^-$, $K^0$, p and $\Lambda$. The average transverse momentum increases with increasing mass of the particle produced and tends to increase with increasing energy. (auth)

**1391** $\bar{K}^*(892)$ PRODUCTION IN THE THRESHOLD REGION. Merrill, D. (Univ. of Chicago); Barletta, W.; Conforto, B.; Harmsen, D.; Lasinski, T.; Levi Setti, R.; Burkhardt, E.; Oberlack, H. Nucl. Phys., B60: No. 1, 315-337(1973).

The reactions $K^-p \rightarrow pK^{*-}(892)$ and $K^-p \rightarrow n\bar{K}^{*0}(892)$ were studied near threshold ($\simeq$1080 MeV/c). The data analyzed include events from the final states $pK^-\pi^0$, $p\bar{K}^0\pi^-$ (both seen and unseen $\bar{K}^0$), and $nK^-\pi^+$, obtained with the Saclay 81 cm hydrogen bubble chamber exposed to the CERN proton synchrotron at 23 different $K^-$ momenta between 777 and 1226 MeV/c. Partial $\bar{K}^*$ cross sections and production and decay angular distributions are presented. Coherent interference between the $\bar{K}^*$ and background amplitudes is suggested as an explanation for the observed properties of the $N\bar{K}\pi$ final states. The results presented establish the leading edge of the $N\bar{K}^*$ excitation function. (auth)

**1392** $\pi^+p$ INTERACTIONS AT 8 GeV/c WITH LOWEST ENERGY PER PARTICLE (TEN PRONG EVENTS). Aniola, L. (Jagellonian Univ., Krakow); Bartke, J.; Coghen, T. Nucl. Phys., B60: No. 1, 338-346(1973).

Ten prong $\pi^+p$ interactions at 8 GeV/c incident momentum are analyzed. In contrast to single-particle distributions which are found to be consistent with phase space, deviations from phase space are observed in the case of some two- and more particle distributions. (auth)

**1393** REACTION $K^+d \rightarrow K^0pp$ AT 4.6 GeV/c. Dehm, G. (Max Planck-Institut fuer Physik und Astrophysik, Munich); Geist, W.; Gobel, G. Nucl. Phys., B60: No. 1, 493-504(1973).

In an experiment with the CERN 2m deuterium bubble chamber the reaction $K^+d \rightarrow K^0pp$ (1) and the related reaction $K^+n \rightarrow K^0p$ (2) are studied at an incident momentum of 4.6 GeV/c. The cross section for the latter reaction is found to be slightly larger than the cross section for the reaction $K^-p \rightarrow \bar{K}^0n$ at the same energy.

The corresponding differential cross sections agree within the rather large uncertainties. The forward amplitude for reaction (2) is predominantly real. Moreover, the total and forward differential charge exchange cross section values are compatible with those predicted on the basis of an SU(3) sum rule. A comparison of the $K^{\pm}$-charge exchange differential cross sections with the predictions of a Regge pole model is also presented. (auth)

# Particle Interactions and Properties (Theoretical)

## General

*Refer also to abstract 1961.*

**1394** (CNRS-CPT-73-P-541) STRING PICTURE OF THE VENEZIANO AMPLITUDE. Banyai, L. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). May 1973. 18p. Dep. NTIS (U. S. Sales Only) $3.00.

The quantization of a free light string, whose action is proportional to the surface swept out by the string, coupled to external sources was proposed and connected to the Veneziano amplitude, within the framework of the functional integral formalism. Some details of the string picture are discussed, especially its functional integral representation and symmetry properties. The results confirm the possibility of gauge invariant string picture of the external field problem. (auth)

**1395** (IFVE-STF-73-3) QUARK MODEL FOR MULTIPARTICLE AND INCLUSIVE REACTIONS. Anisovich, V. V.; Shekhter, V. M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 29p. (In Russian). Dep. NTIS (U. S. Sales Only) $3.50.

The inclusive processes at asymptotic high energies are considered in the framework of quark model. The relations for particle output in different ranges are described. (auth)

**1396** MULTIPLICITY DISTRIBUTION IN HIGH ENERGY COLLISIONS. Tomozawa, Y. (Stanford Univ., CA). Nucl. Phys., B62: 539-544(1973).

It is shown that the asymptotic multiplicity distribution approaches a Gaussian distribution. The agreement with the experimental data indicates that the higher correlations should not be so strong. (auth)

**1397** MODEL OF THE THEORY OF ELEMENTARY PARTICLES IN SPACE WITH CURVATURE. Leble, S. B.; Terent'ev, I. A. (Leningrad State Univ.). Teor. Mat. Fiz.; 16: No. 3, 291-302(Sep 1973). (In Russian).

Quantum mechanics in a six-dimensional space with curvature is considered. Equations of motion for the elementary objects with arbitrary spin are obtained. As an illustration, the spectrum properties of the mass operator are studied for the particles having spin equal to zero, or ½ or 1. (auth)

## Electromagnetic

**1398** (CNRS-CPT-73-P-539) MINIMAL COUPLING AND MAGNETIC CHARGE. Combe, P.; Richard, J. L. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). May 1973. 17p. Dep. NTIS (U. S. Sales Only) $3.00.

The most general form of the Lagrangian of a particle in a constant and uniform electromagnetic field is derived using a group theoretical argument based on the Levy-Leblond approach to the Lagrangian gauge problem. The minimal coupling is derived. In the case of a pure magnetic field, it is shown that the principle of minimal coupling by the magnetic charge breaks down if the invariance of the equations of motion under space reflection is required. (auth)

**1399** (COO-3285-10) ELECTROPRODUCTION OF PSEUDOSCALAR MESONS AT LARGE TRANSVERSE MOMENTA. Domokos, G.; Kovesi-Domokos, S.; Yunn, B. C. (Science Research Council, Chilton (UK). Rutherford High Energy Lab.). Jul 1973. Contract AT(11-1)-3285. 11p. (RL-73-76). Dep. NTIS (U. S. Sales Only) $3.00.

Inclusive electroproduction of spinless (pseudoscalar) mesons at large transverse momenta is studied in the framework of local scale invariance. Scaling laws are established for the structure functions and approximate analytic expressions are derived for the scaling functions. It is predicted that the cross section decreases essentially according to a power law as a function of the transverse momentum of the observed meson, similarly to hadronic cross sections. The production rate of heavy mesons is found to rise slowly with the laboratory energy of the virtual photon. (auth)

**1400** (RL-73-101) ANALYSIS OF ELECTROMAGNETIC MASS SHIFT IN LIGHT CONE ALGEBRA. Fayyazuddin; Raizuddin. (Science Research Council, Chilton (UK). Rutherford High Energy Lab.). Sep 1973. 10p. Dep. NTIS (U. S. Sales Only) $3.00.

Within the framework of light cone algebra, it is shown that logarithmic divergence in the electromagnetic mass shift of a hadron arises precisely due to mass term in the quark propagator. This divergence, therefore, can be removed by mass renormalization. The coefficient of this divergence is a scalar density which transforms as $S_3$ for the case of nucleon. In the present analysis, the gauge invariance to order $1/q^2$ is explicitly used. (auth)

**1401** GRAVITATIONAL FARADAY-EFFECT. Dehnen, H. (Constance Univ., Ger.). Int. J. Theor. Phys.; 7: No. 6, 467-474(1973).

The influence of the gravitational field upon the direction of polarization of electromagnetic radiation is generally discussed and for the special case of the gravitational field of a rotating homogeneous ring quantitatively calculated in linear approximation. (auth)

**1402** APPROACH TO ASYMPTOPIA IN DEEP INELASTIC SCATTERING AND ANNIHILATION. Osborn, H.; Woo, G. (Cambridge Univ., Eng.). Nucl. Phys., B62: 413-443(1973).

The approach to Bjorken scaling is considered in a covariant parton model framework and two possibilities are demonstrated. Either scaling is approached like $0(\nu^{-1})$, when all integrals are strongly convergent which may imply that the Regge limit for scaling functions is achieved relatively slowly, or the approach can be like a fractional power. By using parameters obtained elsewhere from pp → $\pi + X$ at large transverse momentum it suggested that scaling is achieved like $\nu^{-1/4}$. For spin-½ models this entails $\sigma_S/\sigma_T \sim \nu^{-1/4}$. It is also shown how in the spin-½ case the longitudinal structure function can even scale as occurs in low order perturbation theory. The scaling functions for $e^-e^+$ annihilation are also considered and it is verified that nonfinite asymptotic multiplicities can be obtained. The constraints of various energy momentum sum rules are carefully studied and it is shown how this leads to the usual parton formula for the asymptotic cross sections for $e^-e^+ \to$ hadrons. (auth)

**1403** DEEP-INELASTIC SCATTERING, PARTONS, AND STRONG INTERACTION IDEAS. Chaichian, M. (CERN, Geneva); Kitakado, S.; Zarmi, Y.; Lam, W. S. Nucl. Phys., B61: 77-101 (1973).

The quark-parton model as applied to deep-inelastic lepton-hadron scattering is used as a laboratory model for the study of ideas encountered in strong interaction physics. First, two-component duality constraints are imposed on single-particle inclusive deep-inelastic distributions. In the target fragmentation region this involves a modification of the definition of the E functions introduced by Feynman. A duality relation connecting neutrino and electroproduction single-particle inclusive distributions is obtained. For $\omega \to 1$ and $\omega \to \infty$ in the target fragmentation region an excess of $\pi^+$ over $\pi^-$ production for proton targets and an excess of $\pi^-$ over $\pi^+$ for neutron targets are predicted. For deuteron targets an excess of $\pi^-$ over $\pi^+$ for $\omega \to 1$ is found. In a laboratory model the analogue of the problem of approach to Feynman scaling encountered in hadronic reactions and the related problem of exoticity criteria are studied. It is found that for large $\omega$, in both fragmentation regions, Feynman scaling is reached from above. If ab is exotic, single particle inclusive distributions for any type of observed hadron are flat as a function of $\omega$. For the production of fast hadrons in the fragmentation regions, even when ab is not exotic, cross sections are flat when $ab\bar{c}$ is exotic. (auth)

**1404** HARD PHOTON CORRECTIONS FOR $e^+e^- \to \gamma\gamma$. Berends, F. A. (Leiden Univ.); Gastmans, R. Nucl. Phys., B61: 414-428(1973).

The differential cross section for $e^+e^- \to \gamma\gamma$ is calculated to order $\alpha^3$ for the case of $e^+e^-$ colliding beam experiments. Special attention is given to hard photon corrections. For a specific experimental set-up, detailed numerical results are presented. It is found that the radiative corrections can be quite large in the forward direction. (auth)

**1405** UNIFIED GAUGE THEORIES AND THE ELECTRON-MUON MASS RATIO. Frenkel, J.; Ebel, M. E. (Univ. of Wisconsin, Madison). Nucl. Phys., B61: 230-244(1973).

The general problem of constructing unified gauge theories of weak and electromagnetic interactions with a calculable electron-muon mass ratio is considered. It is shown that severe restrictions upon the particular group representations employed result from the requirement that this mass ratio be calculable and not zero. Several examples are given. Specifically, it is noted that gauge theories based on the groups $SU(3) \otimes SU(3)$ and $SU(4) \otimes SU(4)$, which make use of only the known leptons, cannot explain the observed mass ratio in a simple and meaningful way. (auth)

**1406** WRONG SIGNATURE FIXED POLE IN INCLUSIVE ELECTROPRODUCTION AND PHOTOPRODUCTION. Snell, V. (Cambridge Univ., Eng.). Nucl. Phys., B61: 488-501(1973).

The residues of the third-spectral-function and current-algebra $J = 1$ wrong-signature fixed poles are calculated at $t = 0$ and the connexion between them shown, using finite energy sum rules. In addition to the part of the third-spectral-function pole which is singular as $t \to 0$, the part regular at $t = 0$ is significantly different from zero for $0 \leq -q^2 \leq 1$ $(GeV/c)^2$. (auth)

**1407** ELECTROPRODUCTION OF PIONS WITH POLARIZED BEAMS AND POLARIZED TARGETS. Bartl, A. (Univ., Mainz); Majerotto, W. Nucl. Phys., B62: 267-285(1973).

A general analysis of single pion electroproduction with polarized leptons and polarized target but undetected final state polarizations is presented. Suitable asymmetries for cross section measurements are defined. A discussion of $\pi^+n$ production at high energies is given and predictions are made on the basis of a Born term model and a Regge model extrapolated from photoproduction. (auth)

**1408** LOW-ENERGY THEOREMS FOR COMPTON SCATTERING ON TARGETS OF ARBITRARY SPIN, WITHOUT C, P, AND T INVARIANCES. Lin, K. Y. (National Tsing Hua Univ., Hsinchu, Taiwan). Nucl. Phys., B62: 203-211(1973).

Low-energy theorems for Compton scattering on targets of arbitrary spin are derived. Lorentz invariance but not C, P, and T invariance is assumed. It is shown that the scattering amplitudes are determined to the second order in photon energy by the electric charge, dipole electric moment, dipole magnetic moment, quadrupole electric moment, quadrupole magnetic moment, and seven structure-dependent constants. The low-energy theorems for $e^4$ Compton scattering on spin-$\frac{1}{2}$ targets derived by Lin and Kung are generalized to targets of any spin. (auth)

**1409** ELECTROMAGNETIC PION RADIUS COMING FROM $\pi^{\pm\,4}$He SCATTERING. Nichitiu, F.; Shcherbakov, Yu. A. (Joint Inst. for Nuclear Research, Dubna, USSR). Nucl. Phys.; B61: 429-437(1973).

The influence of ambiguity in phase-shift analysis, of the total cross section and the beam energy on the electromagnetic pion radius derived from $\pi^{\pm\,4}$He elastic scattering measurements is analysed. It is shown that the pion radius obtained from existing experiments is $\langle r_\pi^2 \rangle^{1/2} = 0.80 \pm 0.40$ fm. (auth)

**1410** PRODUCTION OF BOSON PAIRS IN ALTERNATING EXTERNAL FIELD. Perelomov, A. M. (Inst. of Theoretical and Experimental Physics, Moscow). Teor. Mat. Fiz.; 16: No. 3, 303-314(Sep 1973). (In Russian).

Group-theoretical aspects of the problem of production of boson pairs in the homogeneous alternating external field are considered. It is shown that the dynamical symmetry group of the problem is the group SU (N, N) ($N = 2S + 1$, S being the spin of the particle) and the state of the system, which arises from the vacuum state in the evolution process, is the generalized coherent state. Probability of the pair production is given by the squared modulus of matrix element of the representation of the dynamical group. (auth)

**1411** EFFECTS OF MESONIC CURRENTS OF THE PHOTODISINTEGRATION OF THE DEUTERON AT LOW ENERGIES. Hadjimichael, E. (Univ. of Sussex, Eng.). Phys. Lett.; 46B: No. 2, 147-151(17 Sep 1973).

Corrections due to mesonic currents in the reaction $d(\gamma,n)p$ at photon energies up to 22.2 MeV were calculated. Whereas the enhancement of the total and differential cross section is small, the effect is more pronounced in the polarization of outgoing protons and neutrons. (auth)

**1412** AUTOMODELITY AND ASYMPTOTICS ON THE MASS SHELL ON THE BASIS OF THE JOST–LEHMANN–DYSON REPRESENTATION. Vitsorek, E.; Matveev, V. A.; Robashik, D.; Tavkhelidze, A. N. (Joint Inst. for Nuclear Research, Dubna, USSR). Teor. Mat. Fiz.; 16: No. 3, 315-327(Sep 1973). (In Russian).

The connection between the automodel behavior in the deep inelastic region and the asymptotics on the mass shell is studied on the basis of the Jost–Lehmann–Dyson representation. The examples of the weight functions giving rise to the automodel behavior for the deep inelastic ep-scattering and to the constant total cross section for the real Compton effect are constructed. The corresponding weight functions $\psi(u,\lambda^2)$ possess in the general case the singularities at $u = 0$ (in the sense of generalized functions), which determine the high energy behavior on the mass shell, while the automodel behavior is determined by the asymptotics $\psi(u,\lambda^2)$ in $\lambda^2$. The examples of the causal structure functions are given, which demonstrate the importance of the time-like region $q^2 > 0$ for finding the leading singularity of the current commutator on the light cone. (auth)

**1413** RELATIVITY AND QUANTIZATION. IV. A Unified Field Model of a Charged Particle (Model $OK_2^+$). Anastassov, A. H. (Univ. of Sofia). Nuovo Cim., B; 17: No. 1, 99-104(11 Sep 1973).

A new nonsingular unified field model of a charged particle is proposed with effective gravitational mass $M_0$, global energy $M_0c^2$ and effective charge $e^2 = 2bM_0c^2$, where b is a characteristic constant. (auth)

**1414** ANOMALOUS MAGNETIC MOMENT OF THE MUON IN WEINBERG'S MODEL. Kikugawa, H.; Sasaki, R. (Tokyo Univ.). Progr. Theor. Phys. (Kyoto); 49: No. 5, 1776-1777(May 1973).

It is pointed out that the difference between the n-dimensional method and the dispersion relation approach for evaluating the W boson contribution to the anomalous magnetic moment of the muon in Weinberg's model consists in the order of integration. (LBS)

**1415** PHOTO- AND ELECTROPRODUCTION OF CHARGED $\pi$ MESONS AT MODERATELY HIGH ENERGIES. Gakh, G. I.; Omelayenko, A. S. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 8, 1255-1261(Aug 1973). (In Russian).

A model considering, besides the Born amplitude, the contribution of $\Delta$-isobar in s-canal is suggested for the processes of photo- and electroproduction of charged $\pi$-mesons at energies of $\gamma$-quanta $E\gamma = 1$ to 5 GeV and small transferred momenta $(-t \approx m_\pi^2)$. The experimental data available at present for the reactions of charged $\pi$-meson photoproduction and for the reaction of $\pi^+$-meson electroproduction (obtained by the method of coincidences) are in agreement with the considered model. (auth)

**1416** PRIMAKOV'S EFFECT IN THE REACTION OF MESON ELECTROPRODUCTION. Omelaenko, A. S.; Gakh, G. I. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 8, 1249-1254(Aug 1973). (In Russian).

Primakov's effect (photoproduction of neutral pseudoscalar mesons in the Coulomb fields) is generalized for the case of electroproduction of these mesons in the electromagnetic field of a nucleon. Contribution of this mechanism to the cross sections of longitudinal and transverse absorption of $\gamma$-quantum is studied in detail. (auth)

**1417** VECTOR MESON WITH ANOMALOUS MAGNETIC AND QUADRUPOLE ELECTRIC MOMENTS IN THE CENTRAL FIELD. Vlasov, P. A. (Dnepropetrovsk State Univ., USSR). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 8, 1238-1241(Aug 1973). (In Russian).

The motion of vector mesons with anomalous magnetic and quadrupole electric moments in a spherically symmetric field is considered. Two ways to include the anomalous interaction are used. The radial and angular parts in the wave equation may be separated by applying the motion integrals and a set of projection operators. The peculiarities of anomalous interactions in the states with different quantum numbers are discussed. (auth)

**1418** PHOTO- AND ELECTROPRODUCTION OF CHARGED $\pi$ MESONS ON NUCLEI AT HIGH ENERGIES. Kulish, Yu. V. (Physical Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 7, 1057-1059(Jul 1973). (In Russian).

The photo- and electroproduction processes of charged $\pi$-mesons on nuclei with spin 0 and $\frac{1}{2}$ are considered at high energies and small angles $\theta$ ($\theta$ is the angle between the momenta of a $\pi$-meson mass, of the mass difference between the final and initial nuclei as well as of the spins and parity of the nuclei on the differential cross sections behavior are studied for a one-pion gauge invariant model which takes into account the $\gamma$ quantum interactions with electric charges of the nuclei only. (auth)

**1419** MULTIPOLE (KINEMATIC) ANALYSIS OF THE REACTION $eN \to e\pi\Delta$. 1. Invariant and Scalar Amplitudes. Zayats, A. A. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 7, 1136-1140(Jul 1973). (In Russian).

The spin structure of the processes $eN \to e\pi\Delta$ amplitude and the relation of invariant amplitudes with amplitudes in s. c. m. are discussed. Formulas are presented for the differential cross section of the process $eN \to e\pi\Lambda$ in terms of scalar amplitudes. (auth)

**1420** PION ELECTROPRODUCTION AND PHOTOPRODUCTION INCLUDING PCAC. Dombey, N. (Univ. of Sussex, Brighton, Eng.); Read, B. J. Nucl. Phys., B60: No. 1, 65-92 (1973).

The PCAC constraints on pion electroproduction and photoproduction are considered in order to construct models applicable to these processes at low and high energies. In particular the roles of the nucleon axial vector form factor and the pion electromagnetic form factor are investigated. (auth)

**1421** STATISTICAL AND THERMODYNAMIC DESCRIPTIONS OF HADRON PRODUCTION IN $e^+e^-$ ANNIHILATION. Engels, J. (Univ., Bielefeld, Ger.); Schilling, K.; Satz, H. Nuovo Cim.; 17A: No. 4, 535-556(21 Oct 1973).

The statistical model and the thermodynamic (statistical bootstrap model are formulated for multihadron production in $e^+e^-$ annihilation. Asymptotic results are derived for both approaches, with particular attention to critical features subject to experimental test. Quantitative predictions of multiplicities, average secondary energies and inclusive single-particle distributions are presented for storage ring centre-of-mass energies from 2 to 6 GeV. (auth)

**1422** COMPTON SCATTERING AND VECTOR-MESON PHOTOPRODUCTION. Kellett, B. H. Univ. of Manchester, Eng.). Nuovo Cim.; 17A: No. 4, 603-624(21 Oct 1973).

A recently proposed model for Compton scattering and deep inelastic electroproduction is extended to describe vector-meson photoproduction. Vector-meson dominance is formulated covariantly in terms of invariant amplitudes, and the assumption of a smooth zero-mass limit leads to definite relations between the amplitudes for the different processes. The breaking of simple vector dominance observed in these reactions is accounted for by an additional mass dependence. A good fit to the vector photoproduction data is obtained. (auth)

**1423** DIMENSIONAL REGULARIZATION, ABNORMAL AMPLITUDES, AND ANOMALIES. Akyeampong, D. A.; Delbourgo, R. (Imperial Coll. of Science and Tech., London). Nuovo Cim.; 17A: No. 4, 578-586(21 Oct 1973).

Identifying axial vectors and pseudoscalars as antisymmetric 3-component and 4-component tensors in space-time of arbitrary dimensions, we discover a new PCAC law: $\partial_K\bar{\Psi}\Gamma_L\Gamma_M\Gamma_N\Psi = 2mi\bar{\Psi}\Gamma_K\Gamma_L\Gamma_M\Gamma_N\Psi - \frac{1}{5}\, i\bar{\Psi}(i\overleftrightarrow{\partial}^J + 2eA^J)\Gamma_J\Gamma_K\Gamma_L\Gamma_M\Gamma_N\Psi$, where the extra term on the right-hand side does not exist in 4 dimensions. However, when we do descend to 4 dimensions after dimensional regularization it is precisely the axial vector anomaly. In a parallel calculation we have also shown how to obtain the anomaly in the matrix elements of the trace of the stress tensor. (auth)

**1424** $\pi^0 \to 2\gamma$ DECAY FOR A REAL PION. Furlan, G.; Legovini, F.; Paver, N. (Univ., Trieste, Italy). Nuovo Cim.; 17A: No. 4, 635-651(21 Oct 1973).

Using a general method, the extrapolation of the soft-pion result for $\pi^0 \to 2\gamma$ decay, given by the Adler anomaly, to the physical region is discussed, emphasizing in particular the role played by vector dominance and chiral-symmetry breaking. The extrapolation effects turn out to be, in our approach, relatively small, in agreement with the PCAC smoothness assumption. Recent alternative treatments are briefly commented. (auth)

**1425** ANOMALIES IN PHOTON–PHOTON SCATTERING REACTIONS. Kingsley, R. L. (Cambridge Univ., Eng.). Nucl. Phys.; B60: No. 1, 45-51(1973).

Diagrams contributing to logarithmic enhancements in parton-model calculations for electroproduction off photons are examined, and their interpretation in terms of the bilocal algebra is considered. (auth)

**1426** POLARIZABILITY CONTRIBUTIONS TO THE NEUTRON–LEPTON AMPLITUDE AT THRESHOLD. Bernabeu, J. (CERN, Geneva); Jarlskog, C. Nucl. Phys.; B60: No. 1, 347-366 (1973).

Motivated by recent interest in the neutron-electron scattering amplitude at threshold, a detailed investigation of the two-photon exchange contribution, commonly known as the polarizability correction, to this amplitude is made, for general lepton mass. The contribution is related to the amplitudes describing forward virtual Compton scattering on neutrons. To calculate it, dispersion relations are written for the Compton amplitudes and use is made of the present knowledge of the neutron structure functions as well as the scaling hypothesis. The correction is much larger for muons than for electrons. Further, the region of validity of the extreme relativistic and the classical approximations treated in the literature are discussed by giving the relevant parameter which leads naturally from one case to the other. (auth)

**1427** SCALING AND THE ASYMPTOTIC BEHAVIOR OF FORM FACTORS. Divakaran, P. P. (Weizmann Inst. of Science, Rehovot, Israel); Rajasekaran, G. Nucl. Phys.; B60: No. 1, 437-442(1973).

It is shown that if all spin averaged matrix elements for the production of an arbitrary hadronic state $|i\rangle$ by the absorption of a virtual photon of momentum q on a proton vanish as $q^2 \to \infty$ (spacelike), and if this asymptotic behavior satisfies a certain smoothness condition when $m_i^2$ also becomes large, then Bjorken scaling requires the vanishing to be faster than any power of $q^2$. Commonly accepted analyticity properties of the relevant amplitudes are assumed. (auth)

**1428** COMMENT ON THE FORWARD ANGLE $pp\gamma$ DATA at 156 MeV. Celenza, L.S.; Liou, M.K.; Sobel, M.I. (Institute for Nuclear Theory and Department of Physics, Brooklyn College of the City University of New York, Brooklyn, N. Y. 11210); Gibson, B.F. Phys. Rev. C 8: No. 2, 838-840 (Aug 1973).

Proton–proton bremsstrahlung cross sections at 156 MeV are calculated and compared to the Orsay experimental data. Both relativistic effects and noncoplanar effects are found to be important for forward–angle scattering. Agreement with Orsay's data is much better if these effects are included. (auth)

**1429** THEOREMS AND BOUNDS RELATING TO THE TWO–PHOTON DECAY OF THE PION. West, G.B. (Stanford Linear Accelerator Center, Stanford University, Stanford, California, 94305). Phys. Rev. Lett. 30: No. 25, 1271-1274 (18 June 1973).

An exact bound on the $\pi^0\to2\gamma$ vertex function is derived. From it, it is possible to estimate bounds to the corrections to the vector–dominance model, the anomalous constant S, and the asymptotic behavior of the form factor. A theorem is derived which states that, under specific assumptions, the coefficient (K) of the axial current in the short–distance expansion of two electromagnetic currents is finite if $\sigma_{e^+e^-} \to 1/s$, but vanishes if $\sigma_{e^+e^-}$ falls faster. (auth)

## Weak

**1430** (IFVE-STF/SEF–72-115) HEAVY LEPTONS. Gershtein, S. S.; Landsberg, L. G.; Folomeshkin, V. N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1972. 50p. Dep. NTIS (U. S. Sales Only) $4.50.

The question on heavy lepton existence was considered. The simplest possibilities of lepton classification by their quantum number and interactions were analyzed, and different ways of experimental search for these particles were outlined. (auth)

**1431** HOW TO ANALYSE VECTOR-MESON PRODUCTION IN INELASTIC LEPTON SCATTERING. Schilling, K. (Univ., Bielefeld, Ger.); Wolf, G. Nucl. Phys., B61: 381-413(1973).

The kinematics of the process $lN \to lNV$ is studied in the one-photon approximation for unpolarized as well as polarized leptons l. The vector-meson spin density matrix is expressed in terms of the s-channel helicity amplitudes in the hadron c.m.s. and the vector-meson decay angular distribution is discussed. The use of longitudinally polarized lepton beams is found to increase considerably the amount of information that can be deduced from the decay distribution. With longitudinal beam polarization it is possible to separate all 26 observable independent density matrix elements into contributions from natural and unnatural parity exchange in the t-channel, respectively. (auth)

**1432** SPIN SUM RULES FOR INELASTIC (ANTI) NEUTRINO– NUCLEON SCATTERING. Ward, B. F. L. (Princeton Univ., NJ). Nucl. Phys., B61: 1-31(1973).

A systematic discussion of the equal-time current-algebra sum rules for the structure functions in inelastic (anti) neutrino-nucleon scattering is presented. The emphasis is on spin-dependent results. All sum rules, both at fixed-$q^2$ and in the Bjorken scaling limit, are obtained by a single procedure which presumes Bjorken scaling. In particular, the procedure yields sensible results in the cases where the familiar infinite momentum method yields nonsense. The procedure requires a complete characterization of the $\nu$-behaviour of the structure functions in the presumed scaling limit. For definiteness, this characterization is achieved by giving the complete quark light-cone scaling behavior together with the complete set of positivity restrictions on the structure functions. After having derived the sum rules, the spin generalization of the $\Delta S = 0$ Nachtmann relations is given following the approach of Callan, et al., as these relations, together with the sum rules, may eventually be of use in determining the precise light-cone formalism. (auth)

**1433** RENORMALIZATION AND DEEP INELASTIC LEPTON–NUCLEON SCATTERING. Gutbrod, F.; Schroeder, U. E. (DESY, Hamburg). Nucl. Phys., B62: 381-401(1973).

A model is investigated for deep inelastic electroproduction, where the photon does not couple to pointlike constituents, but to physical particles with form factors. Scaling behavior for the structure functions is obtained by a compensation between form factor effects and increasing integrals over a propagator spectral function and over a function similar to that corresponding to the vertex diagram. A sufficient condition for scaling is the generalized behavior of a hadronic four point function such that it is more singular than in perturbation theory. In contrast to the standard parton model, the average transverse momenta of final state particles should increase without limit as $-q^2 \rightarrow \infty$. (auth)

**1434** WEAK INTERACTIONS AT HIGH ENERGIES AND COMPLEX ANGULAR MOMENTA. Anselm, A. A.; Gribov, V. N. (Leningrad Nuclear Physics Inst.). Nucl. Phys., B61: 253-273 (1973).

It has been suggested that weak interactions at high energies, $Gs > 1$ (G is the Fermi coupling constant, $\sqrt{s}$ is the c.m.s. energy), become strong so that the partial waves can reach their unitary limit. This hypothesis is the opposite one to the assumption that there exists some special mechanism (e.g. the intermediate W-meson) which cuts off the increase of the partial waves at comparatively small energies $s \ll G^{-1}$, in which case the interaction could remain weak up to very high energies. Elastic lepton scattering and some other leptonic reactions ($e^+ + e^- \rightleftharpoons \mu^+ + \mu^-$) are considered by means of complex angular momentum theory provided $Gs \gg 1$. The main difference with the usual strong interactions consists in the possibility of the exchange of massless particles in the cross t-channel. This results (i) in the appearance of the singularity at $t = 0$ in Regge trajectories and residues and (ii) in the condensation of the Regge poles at $t \rightarrow 0$ in the j-plane along the imaginary axis $\mathrm{Re}\, j = 0$. For inelastic processes such as $e^+ + e^- \rightarrow \mu^+ + \mu^-$ the latter singularities could be the leading ones and the elastic cross section has then a specific oscillating behavior at small momentum transfer. In the case of elastic lepton scattering due to s-channel unitarity there must exist some additional singularity in the right-half j-plane at $t = 0$. The total leptonic cross section satisfies therefore the inequality $\sigma_{tot} >$ const $\cdot\, s^{-1}$ when $s \rightarrow \infty$. (auth)

**1435** FORM FACTORS AND FOURTH ORDER DIVERGENCE CANCELLATIONS IN THE GAUGE THEORY OF WEAK INTERACTIONS. Baran, S. A. (Interactional Centre for Theoretical Physics, Trieste, Italy). Nucl. Phys., B62: 333-349(1973).

The contribution of $W^{\pm}$ particles to the form factors of leptons in the gauge theory of weak interactions is discussed in detail by dispersion-theoretic techniques. It is shown that the form factors are highly divergent in the U-gauge. By calculating fourth order diagrams with $W^-W^+$ and $Z\varphi$ intermediate states for lepton-lepton elastic scattering, it is shown that in spite of the divergent behavior of the unphysical form factors in the U-gauge, the fourth order corrections to the S-matrix elements of lepton-lepton elastic scattering are finite in the same gauge. (auth)

**1436** X-DEPENDENCE OF DEEP INELASTIC NEUTRINO–NUCLEON CROSS SECTIONS. Cleymans, J.; Sehgal, L. M. (Technische Hochschule, Aachen). Nucl. Phys., B61: 479-487 (1973).

Using an approximate version of the quark parton model in conjunction with electron scattering data, the quark number density functions u(x) and d(x) describing the distribution of p- and n-type quarks within the proton are obtained in a limited region of x. These are used to predict the cross sections $d\sigma/dx$ for neutrino and antineutrino scattering from protons and neutrons in a domain which excludes the small-x region. A notable result is the prediction of a rapid and almost linear decrease of the ratio $(d\sigma^{\nu p}/dx)/(d\sigma^{\nu n}/dx)$ with increasing x. (auth)

**1437** LIGHT CONE MASS EXTRAPOLATION IN $K_{l3}$ THEORY. Sazdjian, H. (Institut de Physique Nucleaire, Orsay, France). Nucl. Phys., B62: 286-300.

It is pointed out that presence of the light cone singularity $\partial_\alpha \partial_\beta\, \epsilon(x_0)\, \delta(x^2)\, S(x)$ in current commutators does not modify the type of behavior of current components on null planes, as is suggested by the inelastic ep scattering experiments. Such a singularity is absent in the free quark model. The bilocal operator S could manifest itself by a nonvanishing of the longitudinal scaling function in neutrino production, while in the case of electroproduction the longitudinal cross section is still asymptotically absent, due to the conservation of the electromagnetic current. It could also be responsible for eventual violations of "strong" PCAC. By means of light cone dispersion relations, it is shown that mass shell corrections to low energy theorems depend sensitively on the operator S. In particular the case of $K_{l3}$ suggests its presence in current commutator light cone expansions. (auth)

**1438** ANALYTICITY AND THE PROPERTIES OF THE ELASTIC $\nu e$- AND $\bar{\nu} e$-SCATTERING AMPLITUDES AT HIGH ENERGY. Vernov, Yu. S. (Inst. of Nuclear Research, Moscow). Teor. Mat. Fiz.; 16: No. 3, 423-426(Sep 1973). (In Russian).

The restrictions on the asymptotical behavior of the $\nu e$- and $\bar{\nu} e$-forward scattering amplitudes are found. (auth)

**1439** ITO'S DERIVATION OF THE PHASE OF EPSILON IN NEUTRAL KAON DECAY. Kabir, K. P.; Kenny, B. G. (Univ. of Virginia, Charlottesville). Progr. Theor. Phys. (Kyoto); 49: No. 5, 1754-1755(May 1973).

It is pointed out that Ito's assertion that the phase of $\epsilon$ in the general framework of the Wu-Yang theory is always equal to the super weak value $\phi_s$, independent of the magnitude of CP-nonconservation in individual decay amplitudes, is incorrect. (LBS)

**1440** SOME PECULIARITIES OF THE BORN APPROXIMATION FOR REACTIONS OF NEUTRINO PRODUCTION OF STRANGE PARTICLES ON NUCLEONS NEAR THRESHOLD. Krive, I. V. (Kharkov State Univ.). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 8, 1344-1348(Aug 1973). (In Russian).

The reactions $\nu(\tilde{\nu}) + N \rightarrow 1^-(1^+) + B + M$ (B — baryon with $J^P = {}^1\!/_2$, M — pseudoscalar meson) are considered in the Born model. The case of the large transferred momenta $k^2 > m_K^2$ is studied in particular. In this limit for the $\tilde{\nu}N$—cross sections simple correlations are obtained which depend on the constants of strong interactions only in the corresponding vertices. (auth)

## *Strong (General)*

*Refer also to abstract 1498.*

**1441** COMPOUND POISSON DISTRIBUTION AND KNO SCALING. Le Bellac, M.; Meunier, J. L.; Plaut, G. (Univ., Nice). Nucl. Phys., B62: 350-364(1973).

It is proposed to represent the multiplicity distribution by a compound Poisson distribution suggested by unitary or absorptive multiperipheral models. In this framework, the scaling law proposed recently by Koba, Nielsen and Olesen, and in particular the behavior of non-asymptotic terms are discussed. It is shown that the model is in very good agreement with the present experimental data. (auth)

**1442** INCLUSIVE APPROACH TO SELF-CONSISTENT MULTIPERIPHERAL MODELS. Green, M. B.; Webber, B. R. (Cavendish Lab., Cambridge, Eng.). Nucl. Phys., B61: 370-380(1973).

By making use of relations between inclusive and exclusive cross sections it is shown how to construct self-consistent multiperipheral models with a leading j-plane singularity with unit intercept. As an illustrative example a model is described in which the input is a total cross section of the form $\sigma_{tot} \sim \gamma\,(1 + d/\ln s)$ and factorization of inclusive cross sections. Constraints which lead to a two-component picture of exclusive cross sections are obtained. The elastic cross section falls less quickly than the inelastic ones and the multiplicity moments exhibit long-range correlations. As in other multiperipheral models, the predicted total cross section does not rise to its asymptotic limit (i.e. $d \gtrsim 0$). (auth)

**1443** CONSTITUENT PICTURE OF TWO-BODY SCATTERING AT LARGE ANGLES. Fishbane, P.; Quigg, C. (State Univ., of New York, Stony Brook). Nucl. Phys., B61: 469-478(1973).

A quark counting picture for the sizes of wide-angle scattering cross sections is developed in order to illustrate the idea that such scattering is influenced by the pool of hadronic matter provided by the incident particles, and not by the separate identities of those particles. The model predictions provide a background for the interpretation of future experiments. (auth)

**1444** VORTEX-LINE MODELS FOR DUAL STRINGS. Nielsen, H. B.; Olesen, P. (Univ. of Copenhagen). Nucl. Phys.; B61: 45-61(1973).

Attention is called to the possibility of constructing field theories for the dual string. As an example, it is shown that a Higgs type of Lagrangian allows for vortex-line solutions, in analogy with the vortex lines in a type II superconductor. These vortex lines can approximately be identified with the Nambu string. In the strong coupling limit it is speculated that the vortex lines make up all low energy phenomena. It turns out that this strong coupling limit is "super quantum mechanical" in the sense that the typical action of the theory is very small in comparison with Planck's constant. (auth)

**1445** GAUGE PROPERTIES OF THE DUAL MODEL POMERON–REGGEON VERTEX: THEIR DERIVATION AND THEIR CONSEQUENCES. Brink, L.; Olive, D.; Scherk, J. (CERN, Geneva). Nucl. Phys., B61: 173-198(1973).

Study of the non-planar orientable single dual loop diagrams in 26 space-time dimensions has revealed an infinite positive-definite spectrum of "pomeron" intermediate states which couple to reggeons via a bilinear pomeron–reggeon vertex operator. General algebraic techniques are developed to derive the behavior of this vertex with respect to the Virasoro gauge operators. A reflection and transmission behavior is found, reminiscent of the behavior of a wave incident at the interface between two different media (in this case reggeonic and pomeronic). These gauge properties are such as to guarantee the desired "good properties", namely completeness of the transverse reggeon states when coupled between physical reggeon states on one side, and on the other side, either physical pomeron states or else physical reggeon states created via an intermediate pomeron. This is yet another example of the amazing and gratifying self-consistency of the dual model with respect to duality, transversality and unitarity. (auth)

**1446** EXPLICIT SOLUTION OF THE STATISTICAL BOOTSTRAP EQUATION FOR BOSE STATISTICS. Fabricius, K.; Wambach, U. M. (Univ., Biefefeld, Ger.). Nucl. Phys., B62: 212-220(1973).

The bootstrap equation for bosons is solved by making use of a mass gap. The unique solution is for finite energies a finite sum of phase-space integrals. Recursion formulae for the coefficients are given and a method for the determination of the highest temperature is developed. (auth)

**1447** QUANTUM NUMBER CONSERVATION IN THE STATISTICAL BOOTSTRAP OF FIREBALL DECAY SPECTRA. Ilgenfritz, E. M.; Kripfganz, J. (Karl-Marx-Univ., Leipzig). Nucl. Phys., B62: 141-159(1973).

Quantum number conservation is considered within the statistical bootstrap model by generalizing the bootstrap equation for the generating functional of fireball decay spectra. Explicit solutions are given for the level density and the generating functional in the case of additive quantum numbers as well as isospin conservation. Asymptotic expressions for the level density, the inclusive single and two-particle distributions and the generating function of the multiplicity distribution are derived in the case of charge conservation. Multiplicity moments from proton–antiproton annihilation into pions are compared with the model. (auth)

**1448** INTERCEPT OF THE POMERANCHUK SINGULARITY. Khuri, N.N. (Rockefeller University, New York, New York, 10021). Phys. Rev. Lett. 30: No. 21, 1094-1097 (21 May 1973).

For any unitary theory in which the average multiplicity grows slower than any small positive power of s, and in which the Regge-type asymptotic behaviors $\sigma_{tot}(s) \sim S^{\alpha}P^{(0)-1}$ and $\sigma_{el}$ $(S) \sim S^{2}$ $P^{(0)-2}$ hold, modulo powers of ln(s) for both, I derive a simple, necessary and sufficient condition which guarantees that $\alpha$ (O) = 1. The condition is $\max_n \sigma_n \leq C\sigma_{el}s^{\epsilon}$ for arbitrarily small $\epsilon > 0$ and large enough s, where $\sigma_n$ is the actual cross section for producing n hadrons in the final state, $\sigma_{el}$ is the total integrated elastic cross section, and C is independent of $\epsilon$. (auth)

**1449** VISCOSITY EFFECT IN LANDAU'S HYDRODYNAMICAL MODEL OF PARTICLE PRODUCTION. Hoang, T. F. (Argonne National Lab., IL). Nuovo Cim.; 17A: No. 4, 625-634 (21 Oct 1973).

The ordered velocity distribution of secondary particles has been investigated in the relativistic hydrodynamical model, account being taken of the viscosity. The problem is treated using the analogy with a one-dimensional laminar flow of two films of viscous fluid, alongside and in the opposite direction. The equations of motion are solved in the ultrarelativistic limit for the steady flow. A discussion on the results is presented. (auth)

**1450** PCAC SUM RULES FOR INCLUSIVE REACTIONS. Fabricius, K. (Univ., Bielefeld, Ger.). Nucl. Phys.; B60: No. 1, 61-64(1973).

A set of PCAC sum rules for inclusive reactions is presented. These are the broken symmetry relations equivalent to the known conservation constraints. (auth)

**1451** COULOMB CORRECTIONS IN NONRELATIVISTIC SCATTERING. Hamilton, J. (Nordita, Copenhagen); Overbo, I.; Tromborg, B. Nucl. Phys.; B60: No. 1, 443-477(1973).

Coulomb scattering is put in dispersion theoretic form by using a small photon mass $\lambda$. By carefully separating out the ln $\lambda$ terms a dispersion relation for the Coulomb corrections in hadronic scattering is set up and solved. This is done for repulsive and attractive Coulomb interactions and for a two-channel problem. The techniques are designed so that they can be extended to the relativistic problem. (auth)

**1452** NONPOLYNOMIAL INTERACTIONS AT HIGH ENERGIES. La Camera, M.; Wataghin, A. (Univ., Genoa). Nuovo Cim.; 17A: No. 4, 526-534(21 Oct 1973).

The divergences in QFT are not a consequence of an inadequate treatment of the perturbation expansion, but a consequence of an inadequate choice of the Lagrangian. In this work the question is studied in the case of the elastic scattering of two fermions, with the exchange of a given number of vector mesons and of an increasing number of scalar or pseudoscalar mesons. The Lagrangian chosen is of nonpolynomial character and a quantitative formula is obtained for the massive superpropagator. It is shown that the amplitude so derived in the high-energy approximation behaves in accordance with experiment. It is thought that it will be the basis also for developments in inelastic processes. (auth)

## *Strong (Baryon No. = 0)*

**1453** GRAND ANGULAR MOMENTUM ANALYSIS OF THE REACTION: $\bar{N}N \rightarrow 3\pi$. Bjorneboe, J. (Univ. of Copenhagen). Nucl. Phys., B62: 521-532(1973).

A method of analysis based on the grand angular momentum formalism and applicable to the reaction $\bar{p}n \rightarrow \pi^{+}\pi^{-}\pi^{-}$ and similar processes is presented. A number of model amplitudes are examined and a simple qualitative picture of these reactions is given. (auth)

**1454** PION–PION SCATTERING FROM AN SU(3) × SU(3) INVARIANT LAGRANGIAN. Ecker, G. (Univ., Vienna); Honerkamp, J. Nucl. Phys.; B62: 509-520(1973).

The low energy pion-pion phase shifts are calculated from the SU(3) × SU(3) invariant meson-baryon Lagrangian in the one-loop approximation. The meson loop diagrams are evaluated using superpropagator methods and symmetry arguments. The derivative nature of the meson-baryon coupling leads to one undetermined subtraction constant in the baryon loop amplitudes which is fixed by the requirement that the p-wave exhibits a resonance at the $\rho$ meson mass. Taking the D/F ratio for the meson-baryon couplings from experiment I = 0 and I = 2 s-waves are derived in good agreement with the available data. (auth)

**1455** QUESTIONS IN THEORETICAL DETERMINATIONS OF $\pi\pi$ SCATTERING LENGTHS. Bonnier, B. (CNRS, Paris); Procureur, J. Nucl. Phys.; B61: 155-172(1973).

Using crossing relations on the physical region between the P- and I = 2 S-waves, the range of $\pi\pi$ scattering lengths allowed by $\rho$ meson existence is estimated. The difference of the result with some model predictions is discussed. In particular the role of virtual bound states poles in parametrizations based on current algebra and unitarity constraints is emphasized. The values of the S-wave scattering lengths can be restricted when some experimental information about the S-waves is added, and improved phenomenological lower bounds may then be obtained. (auth)

**1456** COULOMB EFFECTS IN OFF-SHELL $\pi\pi$ SCATTERING. Michael, C. (CERN, Geneva). Nucl. Phys.; B61: 199-204(1973).

Coulomb effects are shown to be strongly suppressed in the off-shell $\pi\pi$ scattering accessible from $\pi N \rightarrow \pi\pi N$ data, and hence Coulomb-interference effects cannot be readily extrapolated to the pion-exchange pole. (auth)

**1457** ANALYTIC PARAMETRIZATION OF HIGH-ENERGY FORWARD SCATTERING AMPLITUDE. I. pp and $p\bar{p}$ Scattering. Bourrely, C.; Fischer, J. (CERN, Geneva). Nucl. Phys.; B61: 513-521(1973).

The pp and $p\bar{p}$ forward scattering amplitude F(E) is represented in a parametric form which is analytic in the cut E plane which gives the asymptotic behavior of the total cross sections $\sigma pp$, $\sigma p\bar{p} \sim$ (log $E/E_0$) $\gamma$, E being the lab energy and $\gamma$ being real. Fits to high energy data favor a $(\log E/E_0)^2$ increase of $\sigma pp \rightarrow \infty$, but admit also other growth rates. The predicted real part of the forward amplitude becomes positive at E about 300 GeV and is equal to 6–10% of the imaginary part at 2000 GeV. (auth)

**1458** YANG–MILLS FIELDS AND PSEUDOSCALAR MESON SCATTERING. Iagolnitzer, D.; Zinn-Justin, J.; Zuber, J. B. (CEN, Saclay, France). Nucl. Phys.; B60: No. 1, 233-266(1973).

A model was studied for pseudoscalar meson scattering ($\pi$,K,$\eta$) based on a Lagrangian in which the mesons are coupled through massive Yang–Mills fields, identified with the physical ($\rho$,K*,$\varphi$) vector meson resonances. The calculation of the various two-body scattering amplitudes were performed, in perturbation, in the one loop approximation, and the Padé summation method has been applied. As a result all the well-known d-wave resonances $f_0$, f', $A_2$ and K*(1420) were generated. No exotic states were found. The $\pi\pi$ and $K\bar{K}$ s-wave phase shifts are in excellent agreement with experimental data; in particular the strong $K\bar{K}$ threshold effect in the $\pi\pi$ scattering can be reproduced. Very broad $\sigma$, $\kappa$, $\delta$ resonances are obtained. In the last section it is shown that the model, which is not renormalizable, is a limit of a renormalizable model containing Higgs–Kibble mesons which would lead to similar results. (auth)

## *Strong (Baryon No. = 1)*

*Refer also to abstract 1505.*

**1459** (INP-833) DISPERSIVE SUM RULES AND THEIR APPLICATIONS IN STRONG INTERACTIONS THEORY. Kwiecinski, J. (Institute of Nuclear Physics, Krakow (Poland)). Apr 1973. 84p. (In Polish). Dep. NTIS (U. S. Sales Only) $6.25.

Problems connected with applications of finite energy sum rules are considered. A certain emphasis is laid on the generalization of these sum rules for the inclusive and production processes. In describing the applications of finite energy sum rules for two-body processes the fixed u continuous moment sum rules are discussed for meson-nucleon scattering. The analytic properties of the 6-point amplitudes in the high energy limit are discussed, exploring the dual resonance model and the perturbation theory model. The finite energy sum rules for the auxiliary Reggeon–particle amplitude and the corresponding sum rules for the inclusive cross sections are derived. These sum rules connect the averaged, inclusive cross sections from the low missing-mass region with the triple Regge pole parameters. The applications of these sum rules in the theory of cuts in the complex angular momentum plane and their applications for the analysis of the inclusive reactions themselves are discussed. The analytic properties of the 5-point amplitudes are considered in the high energy limit and the corresponding finite energy sum rules are derived which connect the average absorptive parts of the amplitude from the region of the low sub-energies with the parameters describing double Regge pole exchange. (auth)

**1460** RELATIVE SIGNS OF RESONANCE FORMATION AMPLITUDES IN A QUARK MODEL. Moorhouse, R. G.; Parsons, N. H. (Univ. of Glasgow). Nucl. Phys.; B62: 109-127(1973).

All the matrix elements for scattering processes meson + baryon → resonance → meson + baryon, when the meson belongs to the pseudoscalar or vector nonet and the baryon to the lowest octet or decuplet, are calculated and tabulated on a quark model. The predictions for SU(3) inelastic processes of this type are nontrivial and critical for naive quark models. Some present and future comparisons with experiments are discussed. (auth)

**1461** DETERMINATION OF THE Δ(1236) POLE POSITION. Nogova, A. (Inst. of Physics, Bratislave); Pisut, J. Nucl. Phys.; B61: 445-454(1973).

The method proposed in the preceding paper is used to determine the position of the Δ(1236) resonance pole on the second Riemann sheet of the pion-nucleon $P_{33}$ partial wave amplitude. The Almehed-Lovelace phase shift is used as the input. The method shows that there is a pole in the second sheet at $s = (M + \frac{1}{2} i\Gamma)^2$ with $M = 1179 \pm 10$ MeV, $\Gamma = 119.5 \pm 10.0$ MeV. Apart from this pole there are no other statistically significant singularities in the second sheet. In principle the method gives truly statistical errors. In practice the data and their estimated errors are completed by additional assumptions so that the error estimates should be taken with some precaution. In order to see how the method works the determination of the resonance parameters is also described for a simple model amplitude with the known position of the second sheet pole. The errors given above are based on the experience with this model amplitude. The result is free of ambiguities connected with specific parametrizations and with the resonance-background separation. (auth)

**1462** HIGH PARTIAL WAVES IN THE PHASE-SHIFT ANALYSIS OF $\pi^+p$ SCATTERING. Alcock, J. W.; Cottingham, W. N. (Univ. of Bristol, Eng.). Nucl. Phys.; B62: 533-538(1973).

Selected $\pi^+p$ scattering data in the momentum range 0.81 to 2.74 GeV/c is subjected to a partial-wave analysis incorporating various models for the high partial waves. (auth)

**1463** KN AMPLITUDES NEAR THRESHOLD FROM DATA AND DISPERSION RELATIONS. Knudsen, C. P. (Nordita, Copenhagen); Martin, B. R. Nucl. Phys.; B61: 307-316(1973).

S- and P-wave KN scattering lengths and amplitudes in the very low energy region ($k_L \leq 600$ MeV/c) for both I = 0 and 1, are obtained from data by a phase shift analysis with dispersion relation sum rule constraints. (auth)

**1464** CHARACTERISTICS OF AN INELASTIC VERTEX FROM HADRON–HADRON SCATTERING. Diamond, R. N.; Erwin, A. R.; Loveless, R.; Thompson, M. A. (Univ. of Wisconsin, Madison). Nucl. Phys.; B62: 128-140(1973).

Inelastic $\pi^-p$ events at 25 GeV/c are selected to enhance the likelihood of single-particle fragmentation. The fragmentation vertex is studied as a function of momentum transfer, effective mass and multiplicity. The t-dependence of the inelastic vertex suggests a point-like interaction, and the triple Regge-formalsim shows promise for describing the $M^*$ dependence. (auth)

**1465** SIMPLE PROPERTIES OF CORRECTIONS TO THE REGGE-POLE AMPLITUDES IN CHARGE AND HYPERCHARGE EXCHANGE REACTIONS. Honda, K. (Kanazawa Univ., Japan); Suzuki, T.; Fukushima, K. Progr. Theor. Phys. (Kyoto); 49: No. 5, 1760-1762(May 1973).

The nature of the corrections to the Regge-pole amplitudes for the $\pi^+p \to K^+\Sigma^+$ and $\pi^-p \to \pi^0n$ interactions is investigated directly from experimental data. Interesting and characteristic features of the results are summarized. (LBS)

**1466** MULTIPOLE (KINEMATIC) ANALYSIS OF THE REACTION $\pi N \to \pi N^*(3^-/2)$. Zayats, A. A. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 7, 1131-1135 (Jul 1973). (In Russian).

Relations between different sets of amplitudes: invariant, spiral, scalar, are obtained for the process $\pi N \to \pi N^*(\frac{3}{2}^-)$. Expansion of the scalar amplitudes in multipole amplitudes is obtained by using the spiral amplitude technique. (auth)

**1467** $e^- - e^+$ PAIR PRODUCTION IN CAPTURE OF $\bar{K}$ MESONS BY NUCLEONS. Krive, I. V.; Kulish, Yu. V. (Kharkov State Univ.). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 7, 1081-1087 (Jul 1973). (In Russian).

On the basis of a general kinematic analysis for the processes $M + N \to B + \gamma^*$, the cross sections of the reactions $\bar{K}N \to \Lambda(\Sigma) e^-e^+$ near the threshold are calculated in the Born approximation. For small $k^2$ the cross section $\sigma_L (K^-n \to \Sigma\gamma^*)$ is shown to be very sensitive to difference of charge radii of $\Sigma^-$-hyperon and $K^-$-meson. (auth)

**1468** PHENOMENOLOGICAL INTERPRETATION OF LOW ENERGY PION-NUCLEON SCATTERING. Pelosi, V.; Cirelli, R.; Palombo, F. (Univ., Milan). Nuovo Cim.; 17A: No. 4, 587-602 (21 Oct 1973).

Experimental results on pion-nucleon scattering near threshold are analyzed in terms of a potential interaction. Radii and depths are presented and discussed in the square-well approximation. It turns out that extrapolation of the $P_{11}$-amplitude at negative energies is consistent with a bound state showing the properties of the well-known nucleon state. (auth)

**1469** CROSSING INVARIANT SOLUTION OF BARYON EXCHANGE DEGENERACY AND REGGEON F/D RATIOS. Eguchi, T. (Tokyo Univ.). Nucl. Phys.; B60: No. 1, 277-282(1973).

A crossing invariant solution of baryon exchange degeneracy is found within the framework of SU(3) and no exotics in all channels. Reggeon F/D ratios are predicted to be $(F/D)_{++} = -\frac{1}{3}$ and $(F/D)_{+} = \frac{1}{3}$ for s-channel helicity non-flip and flip amplitudes respectively which are in good agreement with data. (auth)

**1470** TWO-STEP DYNAMICAL PICTURE OF DIFFRACTION DISSOCIATION AND THE HIGH ENERGY BEHAVIOR OF TRANSVERSE MOMENTA. Pokorski, S.; Van Hove, L. (CERN, Geneva). Nucl. Phys.; B60: No. 1, 379-395(1973).

It is known that single diffraction dissociation in few-body hadron collisions is sharply separated from non-diffractive processes even when the latter occupy neighboring regions of phase space. A possible general explanation is that diffraction dissociation of a particle into successive channels of increasing multiplicity is characterized by a competition between these channels, a lower one being abruptly closed by the opening up of the next higher one. It is shown that this explanation works quite well for proton diffraction dissociation in $\pi^-p$ collisions at 16 GeV/c. The reaction is considered as a two-step process, production of a fireball X ($\pi^-p \to \pi^-X$) and decay of X. By analyzing the distributions in the mass of X, it is found that the competition operates sharply between the decay channels $X \to \pi N$, $2\pi N$, $3\pi N$, and that it can be explained by pure phase space effects in the fireball decay. These results imply that the phase space effects just mentioned combined with the small momentum transfer property of the dissociation $\pi^-p \to \pi^-X$ are sufficient to account for the smallness of the transverse momenta $p_T$ of all secondaries in the reactions considered. It is noted that the situation would be different at much larger energies, where fireballs of very high mass could be occasionally produced. Irrespective of whether such heavy fireballs would be produced diffractively or not, phase space arguments now imply that their decay will tend to give both higher multiplicities and higher $p_T$ of the secondaries. The possible interest of these considerations for recent observations of large $p_T$ secondaries at the CERN Intersecting Storage Rings is indicated. (auth)

**1471** DUALITY OF THE SCATTERING AMPLITUDE IN THE COMPLEX ENERGY PLANE. Ferrari, E. (Univ., Rome). Nuovo Cim.; 17A: No. 4, 505-525(21 Oct 1973).

By use of the ordinary dispersion relations evaluated for complex argument, the behavior of the antisymmetric forward pion-nucleon scattering amplitude in the complex $\nu$-plane is exhaustively studied. It is found that duality is better verified off the real axis than for physical energies, and that it holds rather well both for the real and imaginary parts down to $|\nu| \sim (2 + 3)$ GeV. The connection of this result with the known finite-energy sum rules is investigated, and a new type of sum rules based on the duality requirement is presented. It is also shown that the subtraction of the Born term improves the agreement between the scattering amplitude and its asymptotic expression over the whole region of interest in the complex $\nu$-plane. Finally, the parameters of the amplitude zones are determined, and the possibility that there might be a connection between such zeros and duality breakdown at low energies is hinted. (auth)

**1472** CIRCULAR POLARIZATION OF $\gamma$-QUANTA IN THE $n + p \to d + \gamma$ REACTION AND THE WEAK P-VIOLATING $NN\rho$ VERTEX. Danilov, G. S. (Leningrad Inst. of Nuclear Physics). Nucl. Phys.; B60: No. 1, 221-232(1973).

Theoretical estimates for the circular polarization of $\gamma$-quanta in the $n + p \to d + \gamma$ reaction usually yield a value about two orders of magnitude below the value given by the experimental data. These estimates use the conventional value for the constant $\Gamma(m_\rho^2)$ of the weak P-violating interaction of nucleons with $\rho$-mesons, based on the consideration of the simplest graph. It is shown that the graphs for $\Gamma(m_\rho^2)$ which ordinarily are not taken into account are in reality quadratically divergent and hence, large (the weak Hamiltonian density being assumed here to have the current-current form). If the cut-off parameter in the quadratically divergent integral determining the quantity $\Gamma(m_\rho^2)$ is chosen to be $\Lambda \sim 10$ GeV, then the discrepancy between the theory and experiment disappears. (auth)

## *Strong (Baryon No. ≥ 2)*

*Refer also to abstracts 1497, 1592, and 1593.*

**1473** -(RL-73-82) MODEL INDEPENDENT ANALYSIS OF THE STRUCTURE IN pp SCATTERING. Phillips, R. J. N.; Barger, V. (Rutherford High Energy Lab., Chilton (England)). Aug 1973. 10p. Dep. NTIS (U. S. Sales Only) $3.00.

An empirical study of the structure at $t \simeq -1.1$ in $d\sigma/dt$ (pp - pp), in terms of two exponential amplitudes plus interference, gives the following results. The steeper exponential shows standard Regge shrinkage, corresponding to a trajectory $\alpha \simeq 1 + 0.3t$. The other exponential slope stays constant; the overall energy dependence of this amplitude is approximately $s^{-1}$ for 10 to 30 GeV, leveling off possibly to a constant at ISR. The relative phase is about 2.1 radians at the lower momenta, becoming 2.5 at ISR. These results suggest a simple physical picture, in which a relatively unstructured shrinking Regge amplitude interferes with an even-signature non-Regge background. This interpretation predicts that the interference minimum in $d\sigma/dt$ is deepest at an intermediate momentum near 175 GeV, where measurements will soon be made at NAL. (auth)

**1474** RISING CROSS SECTIONS AND THE TRIPLE POMERON. Amati, D.; Caneschi, L.; Ciafaloni, M. (CERN, Geneva). Nucl. Phys.; B62: 173-193(1973).

An iterative scheme for the pomeron is proposed. The first iteration generates diffractive large mass production and is found to explain satisfactorily the rise of $\sigma_{tot}$ at ISR energies. This contribution is represented by a non-vanishing triple pomeron coupling g. Asymptotically the iteration procedure generates a renormalization of the pomeron trajectory that ends up at $1 + g$. The Froissart bound is enforced through s-channel absorption. The behavior of $d\sigma_{el}/dt$ can also be reproduced in the model. (auth)

**1475** FRESNEL DIFFRACTION IN HIGH-ENERGY MULTIPLE SCATTERING. Schuermann, B.; Frahn, W. E. (Univ. of Cape Town, South Africa). Nucl. Phys.; B62: 365-380(1973).

The effects of Fresnel diffraction on the multiple scattering of high-energy hadrons in complex nuclei are studied. Starting from a Watson-type multiple scattering series, the free-space propagators are approximated by Fresnel propagators. By employing the unitary transformation that connects the Fresnel and eikonal propagators, a closed expression for the multiple scattering amplitude is derived which is formally similar to the corresponding Glauber expression. The Fresnel diffraction effects manifest themselves in a characteristic Dyson-type ordering of the profile operators with respect to the z-coordinates of the target nucleons. The general formulas are then applied to elastic scattering by a target nucleus represented by an independent particle model. As an example, the amplitude for nucleon-deuteron scattering is explicitly evaluated and compared with a result previously derived by Gottfried. (auth)

**1476** SCALING LIMIT OF pp ELASTIC SCATTERING. Barger, V. (Univ. of Wisconsin, Madison); Halzen, F.; Phillips, R. J. N. Nucl. Phys.; B61: 522-543(1973).

A merger of the empirical scaling law $d\sigma/dt \sim s^{-1.5}p_T^{-14}$, for $pp \to pp$ at high transverse momentum $p_T$ and moderate energy, with the notion of a limiting asymptotic distribution $d\sigma/dt \to f(p_T)$ as $s \to \infty$, suggested by ISR data. The sum of two scaling terms is proposed: $d\sigma/dt \sim s^{-1.5}p_T^{-14} + \epsilon p_T^{-n}$, to represent the entire region $p_T > 1.6$, $s > 15$. The second term gives a limiting distribution asymptotically; it allows ISR data to be fitted, without affecting the fit to existing wide-angle data for $p_{lab} < 25$ GeV. Such formulas predict substantially larger cross sections at NAL energies, than for nonlimiting scaling behavior. Comparative evaluations of fits to large angle pp data are made with various proposed parton and field theory models for scaling behavior and comments are made on corresponding predictions for the 90° energy dependence of $\gamma p \to \pi^0 p$ with experiment. (auth)

**1477** $\Lambda$ BINDING IN NUCLEAR MATTER. Bhamathi, G. (Univ. of Madras); Prema, K.; Seshadri, I. Nucl. Phys.; B62: 496-508(1973).

A non-local separable interaction between the $\Lambda$ and nucleon is assumed and the variation in the $\Lambda$ binding in nuclear matter $(B_\Lambda)$ with the potential parameters is studied. It is found that for a simultaneous fit to scattering data and $B_\Lambda$, including the effect of three-body forces in nuclear matter, the singlet strength parameter turns out to be considerably larger than the triplet strength parameter. (auth)

**1478** ENERGY DEPENDENCE OF MEAN SQUARE CHARGED MULTIPLICITY IN REGGE–MUELLER FORMALISM. Choudhury, S. R.; Majumdar, D. P. (Univ. of Michigan, Ann Arbor). Nucl. Phys.; B61: 502-512(1973).

The energy dependence of the mean square multiplicity is obtained on the basis of a Regge–Mueller analysis, when a pomeron with $\alpha p(0) = 1$ and subsidiary trajectories with $\alpha(0) = \frac{1}{2}$ are present. The expression for $\langle n(n-1)\rangle$ is shown to be of the form $c_1 (\ln s)^2 + c_2(\ln s) + c_3 + c_4 (\ln s)^2/\sqrt{s} + c_5 \ln s/\sqrt{s} + c_6/\sqrt{s}$, with the coefficients given in terms of certain well defined integrals over physically measurable quantities. With available experimental data on inclusive reactions all these coefficients could not be estimated. However, retaining only the terms that survive as $s \to \infty$, a simple expression is obtained for the correlation function $f_2 = \langle n(n-1)\rangle - \langle n\rangle^2$ for which a reasonable estimate has been made. The agreement with experiment is good. (auth)

**1479** PHYSICS AT ENORMOUS MOMENTUM TRANSFERS: AN INTERPRETATION OF THE CERN ISR RESULTS. Harte, J. (Yale Univ., New Haven). Nucl. Phys.; B61: 245-252(1973).

The inclusive cross section for large-$\kappa_\perp$ particles at ISR energies is shown from a bootstrap theory of asymptotic hadron interactions to have an exponential behavior of the form $E\, d\sigma/d^3\kappa \approx s^\nu e - c\sqrt{\kappa_\perp}$. Preliminary data agrees well with this prediction. (auth)

**1480** PRODUCTION OF WEAK-INTERACTION BOSONS IN HIGH-ENERGY PROTON–PROTON COLLISIONS. Jaffe, R. L. (Massachusetts Inst. of Tech., Cambridge); Primack, J. R. Nucl. Phys.; B61: 317-332(1973).

Assuming the validity of the Drell-Yan, parton-antiparton annihilation mechanism, the cross sections for production in inelastic proton–proton scattering of the massive bosons that populate the various gauge models of weak interactions are estimated: charged and neutral vectors $(W^\pm, Z^0)$ and neutral "Higgs" scalars $(\phi)$. Presently available data imply $M_Z \gtrsim 13$ GeV but give no useful bound on $M_W$. These bounds can be substantially improved by future experiments at the ISR. (auth)

**1481** HIGH ENERGY ELASTIC PROTON–PROTON SCATTERING AND THE CHOU–YANG MODEL. Kac, M. (Dept. of Theoretical Physics, Oxford). Nucl. Phys.; B62: 402-412(1973).

The Chou–Yang model with an empirical fit for $G_m^p(t)$ is shown to be in remarkable agreement with recent high-energy proton–proton experiments. This result is compared with the Chou–Yang model employing dipole and Gaussian forms for $G_m^p(t)$, and also with the Glauber multiple-scattering-series approach, considering a three-quark model for the proton. It is found that the agreement of the Chou–Yang model with the data is considerably improved on taking a more accurate account of the electron-proton scattering data using an empirical fit for $G_m^p(t)$. (auth)

**1482** COMPLETE EXPERIMENTS AND UNITARITY EQUATIONS IN ELASTIC NUCLEON–NUCLEON SCATTERING. I. Alvarez Estrada, R. F. (Junta de Energia Nuclear, Madrid); Carreras, B.; Goni, M. A. Nucl. Phys.; B62: 221-266(1973).

The determination of the elastic nucleon–nucleon amplitudes from feasible complete experiments is considered. The elastic unitarity equations for values of the observables which correspond to the physical situation of proton–proton scattering at very low energy are studied and solved. (auth)

**1483** DETERMINATION OF THE INCLUSIVE CROSS SECTION IN THE PIONIZATION REGION FROM PCAC. Fabricius, K. (Univ., Bielefeld, Ger.). Nucl. Phys.; B60: No. 1, 52-60(1973).

Using PCAC the isovector part of the one-pion distribution in the pionization region is related to average multiplicities of pions and nucleons. (auth)

**1484** ANALYSIS OF NN → (ΣK)N AND NN → (ΛK)N CHANNELS AT 6 GeV/c WITHOUT ISOSPIN-EXCHANGE INTERFERENCE. Ansorge, R. E.; Charlesworth, J. A.; Intizar, N.; Neale, W. W.; Rushbrooke, J. G. (Cavendish Lab., Cambridge, Eng.). Nucl. Phys.; B60: No. 1, 157-172(1973).

An analysis of 6 GeV/c data for ten different charge channels belonging to the reactions NN → (ΣK)N and NN → (ΛK)N is made in terms of the one-pion-exchange model and the Deck model. Different charge channels are combined in such a way that interferences between isoscalar and isovector exchanges are eliminated. The results of earlier isospin analyses are used to fix the relative proportions of these exchanges for any particular charge channel combination. The model analysis gives a satisfactory semi-quantitative explanation of the data, and in particular of the longitudinal phase space distributions upon which the earlier isospin analyses were based. (auth)

**1485** SCALING AND LIGHT-CONE DOMINANCE IN HADRONIC INDUCED REACTIONS FROM SPECTRAL REPRESENTATIONS. Konetschny, W. (CERN, Geneva). Nucl. Phys.; B60: No. 1, 419-426(1973).

A generalized Deser–Gilbert–Sudarshan representation for the product of two currents, which has been recently proposed by Cornwall, is used to study the processes $pp \rightarrow \mu^+\mu^-X$ and $pp \rightarrow \pi X$ in the limit of large cm energy s with fixed ratios of all kinematic invariants, and the possible relevance of the leading light cone singularity for this scaling limit. We conclude that the existence of the scaling limit does not necessitate light-cone dominance. The requirement of scaling amounts to assuming suitable smoothness for the spectral weight occurring in the representation. However, such smoothness assumptions must not be pushed too far in order to avoid unphysical results. This is demonstrated with the help of the limiting case of finite transverse momenta and its connection to ordinary hadronic scaling. (auth)

**1486** NARROW-RESONANCE APPROACH TO CURRENT ALGEBRA SUM RULES: MESON–NUCLEUS LOW ENERGY SCATTERING. Gensini, P. (Univ., Lecce, Italy). Nuovo Cim.; 17A: No. 4, 557-577(21 Oct 1973).

$SU_3 \otimes SU_3$ chiral algebra and PCAC have been employed to derive pion and kaon scattering amplitudes on nuclei from sum rules of the Fubini–Furlan type. The nuclear states are described as finite systems in a simple, nonrelativistic impulse approximation. The effects of the break down of chiral $SU_3 \otimes SU_3$ symmetry are described in a $(3,3^*) + (3^*,3)$ model. The $\pi N$ sigma-term turns out to be about 46 MeV and we find good agreement between the model by Gell-Mann, Oakes and Renner and both pion and kaon-nucleus data. (auth)

**1487** UNITARY EIKONAL FORMALISM FOR MULTIPRODUCTION AT HIGH ENERGY. Redei, L. B. (CERN, Geneva). Nucl. Phys.; B60: No. 1, 141-156(1973).

Unitary models for meson production in high energy nucleon-nucleon collisions are discussed in the approximation that all transverse momenta are small and that the center-of-mass energy carried off by the produced secondaries is also small compared to the incoming nucleon momenta. Spin and isospin effects are neglected. It is shown that if the number of modes in which the mesons are produced is finite and if the requirement of crossing symmetry in the meson variables is properly taken into account, then it is possible to derive a general closed explicit expression for the S-matrix elements for all models of this kind. (auth)

**1488** ADDENDUM TO "EFFECTS OF Λ–Σ COUPLING IN ${}^4_\Lambda$H, ${}^4_\Lambda$He, AND ${}^5_\Lambda$He". Gibson, B.F.; Goldberg, A.; Weiss, M.S. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Rev. C 8: No. 2, 837 (Aug 1973).

An error in the estimate of the Λ–Σ coupling effects in the excited states of ${}^4_\Lambda$H and ${}^4_\Lambda$He is corrected and the consequences are explored. (auth)

**1489** EFFECTS OF Λ-Σ COUPLING IN ${}^4_\Lambda$H-${}^4_\Lambda$He. Dabrowski, J. (Physics Department, McMaster University, Hamilton, Ontario, Canada). Phys. Rev. C 8: No. 2, 835-836 (Aug 1973).

It is shown that in the "hyperon + rigid 3N core" model of ${}^4_\Lambda$H - ${}^4_\Lambda$He the Λ-Σ coupling increases the excitation energy of the J = 1 state relative to the J = 0 ground state. (auth)

# Particle Invariance Principles and Symmetries

## General

*Refer also to abstracts 495 and 1971.*

**1490** SYMMETRIC LIE ALGEBRAS OF NON-LINEAR TRANSFORMATIONS OF CONFORMAL TYPE IN QUANTUM MECHANICS. Tilgner, H. (Univ., Marburg, Ger.). Int. J. Theor. Phys.; 7: No. 5, 379-388(1973).

The Koecher construction of simple symmetric Lie algebras is used to realize colineation and conformal Lie algebras of nonlinear transformations of a pseudo-orthogonal vector space in the canonical Weyl algebras, which are used in the Schroedinger representation. The realization maps the linear sub-algebras onto symmetrized polynomials of second degree, whereas the nonlinear parts are mapped onto polynomials of first and third degree. For the two examples the Meyberg Jordan algebras are explicitly given. (auth)

**1491** INFINITE-MOMENTUM REFERENCE FRAMES AND INVARIANCE GROUPS. Blasi, A.; Collina, R. (Univ., Genoa). Nuovo Cim.; 17A: No. 4, 698-706(21 Oct 1973).

The possibility of describing the invariance groups in the infinite-momentum class of references is studied, first with a physically plausible limiting process on the Poincaré group, and then applying a definition of contraction to the same Poincaré group. It is shown how the former does not lead to any group structure, although the two procedures are proven to be equivalent for the corresponding Lie algebras, through a theorem given in the Appendix. (auth)

**1492** UNIQUENESS OF SPONTANEOUSLY BROKEN GAUGE THEORIES. Cornwall, J.M.; Levin, D.N.; Tiktopoulos, G. (Department of Physics, University of California, Los Angeles, California, 90024). Phys. Rev. Lett. 30: No. 25, 1268-1270 (18 June 1973).

We have made a systematic search for theories of interacting heavy vector mesons which have unitarily bound trees. In simple cases (four vector mesons and one scalar particle) the only unitarily bound models are spontaneously broken gauge theories. Evidently, a unitarity bound, which controls high-energy behavior, imposes internal symmetry on heavy-vector- boson interactions. (auth)

**1493** CLEBSCH–GORDAN COEFFICIENTS OF THE LORENTZ GROUP. Verdiev, I. A. (Inst. of Physics, Baku). Teor. Mat. Fiz.; 16: No. 3, 360-367(Sep 1973). (In Russian).

It is shown with the aid of the I. M. Gelfand and M. I. Grayev results that the uniform components of the one-particle zero-mass helicity state $|k, \lambda; \rho>$ ($k^2 = 0$) form the space of irreducible representation of the Lorentz group $\chi(i\rho + \lambda, i\rho - \lambda)$. In spherical coordinates the space coincides with the space of functions f(u) on the group U of unitary matrices. The decomposition of the space of direct product of these representations into invariant subspaces is obtained, as well as the integral representation for the Clebsch–Gordan coefficients in the canonical base. (auth)

## Applications (Electromagnetic and Weak)

*Refer also to abstract 1472.*

**1494** SYMMETRY SCHEME FOR HADRONS, LEPTONS, AND INTERMEDIATE VECTOR BOSONS. Gueret, P. (Institut Henri Poincare, Paris); Vigier, J. P.; Tait, W. Nuovo Cim.; 17A: No. 4, 663-680(21 Oct 1973).

A study of the basic representations of the complex Lie algebra $D_4$ reveals a classification scheme for hadrons, based on four quarks, leptons and intermediate vector bosons. It is postulated that a violent break-down of the symmetry for leptons introduces lepton mixing within a multiplet, leaving a residual symmetry of $U_2$ acting on the doublets $(e, \nu_e)$ and $(\mu, \nu_\mu)$ thereby establishing contact with recent Yang-Mills theories of weak and electromagnetic interactions. A concrete realization of the so-called quark-lepton correspondence enables the weak hadronic current to be constructed which contains the usual Cabibbo terms, and a neutral current which conserves strangeness. (auth)

**1495** SEARCH FOR CP-VIOLATING EFFECTS IN THE DECAYS $K^{\pm} \rightarrow \pi^{\pm}\pi^0\pi^0$. Smith, K. M. (Univ. of Glasgow); Booth, P. S. L.; Renshall, H. R.; Jones, P. B.; Salmon, G. L.; Williams, W. S. C.; Duke, P. J.; Evans, W. M.; Hill, R. E.; Holley, W. R.;

Jones, D. P.; Thresher, J. J. Nucl. Phys.; B60: No. 1, 411-418 (1973).

The charge asymmetry in the total decay rates for the $\tau'$ decay modes of the charged K-mesons was measured. There is no asymmetry at the precision level of ±0.0029. The implications of this result are discussed. (auth)

## *Applications (Strong)*

**1496** CURRENT QUARKS, CONSTITUENT QUARKS, AND SYMMETRIES OF RESONANCE DECAYS. Hey, A. J. G.; Rosner, J. L.; Weyers, J. (CERN, Geneva). Nucl. Phys.; B61: 205-229 (1973).

The transformation between "current" quarks and "constituent" quarks recently suggested by Melosh is examined with respect to its predictions for pionic decays of resonances. It implies the use of $SU(6)_W$ for classifying particle states but not for describing decay processes. Instead, pion emission proceeds via $\Delta L_Z = 0, \pm 1$, where L is the internal ("quark") orbital angular momentum. This decay symmetry is called $SU(6)_W$ ($\Delta L_Z = 0, \pm 1$). It is proven equivalent for any decay $A \to B + \pi$ (where A, B are arbitrary $q\bar{q}$ or qqq hadrons) to the $^3P_0$ quark-pair creation model for such decays, as formulated by Micu, Colglazier, Petersen and Rosner. The roles of final orbital angular momenta l and of $SU(3) \times SU(3)$ subgroups of $SU(6)_W$ are also discussed, and some new predictions are made for decays of meson resonances below 1700 MeV. (auth)

**1497** SU(4)⊗SU(4) LEPTON–HADRON SYMMETRY, AND THE EXISTENCE OF HEAVY CHARMED PARTICLES. Dittner, P.; Eliezer, S. (Department of Physics, Imperial College, Prince Consort Road, London SW7, England); Kuo, T.K. Phys. Rev. Lett. 30: No. 25, 1274-1277 (18 June 1973).

We suggest a lepton–hadron analogy based on the spontaneously broken SU(4)⊗SU(4) symmetry. This leads to the existence of heavy charmed particles ($\gtrsim$ 5GeV), which may explain the rise in the total cross section of pp scattering at $E_{c.m.} \gtrsim 15$ GeV. (auth)

# Scattering Theory

*Refer also to abstracts 1471, 1487, 1965, and 1976.*

**1498** METHOD TO DETERMINE RESONANCE PARAMETERS FROM PARTIAL-WAVE AMPLITUDES. Nogova, A. (Inst. of Physics, Bratislave); Pisut, J.; Presnajder, P. Nucl. Phys.; B61: 438-444 (1973).

A method is proposed for the determination of singularities of an analytic function with data given on the boundary of the analyticity region. The method is based on the Cutkosky's statistical approach to the representation of data by analytic functions. The attention is focused onto the recipes for extracting pole positions. The determination of the mass and width of the Δ(1236) resonance is studied in detail in the accompanying paper. (auth)

**1499** EXCHANGE BY THE HARD AND SOFT QUANTA IN THE HIGH ENERGY SCATTERING OF PARTICLES. Barbashov, B. M.; Nesterenko, V. V. (Joint Inst. for Nuclear Research, Dubna, USSR). Teor. Mat. Fiz.; 16: No. 3, 349-354(Sep 1973). (In Russian).

In the framework of the functional integration method in quantum field theory the method is proposed for constructing scattering amplitude of the particles which interact by means of the exchange of the infinite number of soft quanta and the finite number of hard virtual particles. In this method the form factors of the interacting particles arise in calculations of the scattering amplitude at large angles. It is in agreement with the Wu–Yang conjecture about the elastic form factor role in high energy scattering. (auth)

**1500** CROSSING RELATION FOR THE PRODUCT OF TRANSVERSITY AMPLITUDES. Lin, K. Y. (National Tsing Hua Univ., Hsinchu, Taiwan). Chin. J. Phys. (Taiwan); 11: No. 1, 81-84 (Apr 1973).

The crossing relation for the product of transversity amplitudes is considered for all different mass cases. It is shown that any product of transversity amplitudes, such that the product is free from kinematic singularities and zeroes at those thresholds and pseudo-thresholds which do not coincide with the boundary of the physical region, has a very simple crossing relation: it is equal to the corresponding crossed-channel product up to a constant phase factor. The relations among the crossing angles are discussed. (auth)

**1501** SOME PROPERTIES OF THE DOUBLE SPECTRAL FUNCTION OF A DUAL AMPLITUDE WITH MANDELSTAM ANALYTICITY. Bugrii, A. I. (Inst. of Theoretical Physics, Moscow). Teor. Mat. Fiz.; 16: No. 3, 355-359(Sep 1973). (In Russian).

The behavior of dual amplitude with Mandelstam analyticity in the region of the double spectral function is studied. It is shown that the amplitude satisfies the Mandelstam representation with finite number of the substractions, if the Regge trajectory is restricted by the condition: $\mathrm{Re}\,a(s) \le \mathrm{const}$ for $s \to \infty$. The double spectral function takes its largest values in the strips along its boundary. (auth)

**1502** CONVERGENCE OF THE PERTURBATION THEORY SERIES FOR A NONLOCAL NONPOLYNOMIAL THEORY. Basuev, A. G. (Leningrad State Univ.). Teor. Mat. Fiz.; 16: No. 3, 281-290(Sep 1973). (In Russian).

In previous work the convergence of the perturbation theory series in the translationally invariant case is proved on the basis of correspondence with statistical theory. The direct estimation of the logarithm of generating functional of the Euclidean S-matrix is performed, and the upper bound of the convergence radius in the coupling constant is obtained, which turns out to be proportional to $m^2/\Lambda$, m being the mass of the particle and Λ–the small coupling constant. (auth)

**1503** ANISOTROPIC SCATTERING BOLTZMANN DISTRIBUTIONS AND STRUCTURAL PROPERTIES. Syros, C. Prakt. Akad. Athenon; 120-130(1973).

Previous results are extended and generalized. In particular anisotropic scattering is considered here and explicit solutions are obtained which satisfy the required boundary conditions. The main result presented here is summarized as follows: The Boltzmann distribution with anisotropic scattering kernel of degree L in z is a superposition of distributions of isotropic scattering with coefficients proportional to the L + 1 powers of z. In conclusion, the problem of finding the anisotropic scattering Boltzmann distribution is solved exactly and represented by elementary functions in a very simple way. The present allows one to avoid the Riemann–Hilbert problem concerned with singular integral equations. (MHR)

**1504** ANALYTICITY AND A FINITE-ENEPGY SUM RULE FOR THE REGGEON-PARTICLE AMPLITUDE IN $a + b \to c + d + e$. Hoyer, P. (Oxford Univ.); Kwiecinski, J. Nucl. Phys.; B60: No. 1, 26-44 (1973).

A single-Regge limit of the amplitude for the process $a + b \to c + d + e$ is considered. In this limit the amplitude is proportional to the reggeon-particle amplitude for $a + i \to c + d$, where i is a reggeon. The analytic structure of this amplitude is studied using the dual resonance model and a perturbation theory model. It is concluded that finite-energy sum rules can be derived, which relate the absorptive part of the amplitude at low $(p_c + p_d)^2$ to a part of the double-Regge vertex function of the original five-point amplitude. Some phenomenological applications of the sum rules are discussed. (auth)

**1505** UNDERSTANDING AMPLITUDES FROM AN S-CHANNEL APPROACH. Schrempp, B.; Schrempp, F. (CERN, Geneva). Nucl. Phys.; B60: No. 1, 110-140 (1973).

The systematics of inelastic two-body reactions at high energies is discussed on the basis of a geometrical s-channel approach which was recently proposed. The amplitudes are given in terms of an asymptotically universal s-(and u-) channel trajectory representing the peripheral resonances. Its imaginary part is responsible for the amount of shrinkage, its real part for the structure in differential cross sections, polarizations and density matrix elements. An approximation, valid for $|t| \gtrsim 0.25$ (GeV/c)$^2$, allows for a very simple, qualitative understanding of these structures in a large sample of reactions. The predictions are confronted with many experimental examples, among these the amplitude analysis for $\pi^- p \to \pi^0 n$ at 6 GeV/c. The agreement is good in all cases. As characteristic features for $|t| \gtrsim 0.25$ (GeV/c)$^2$ emerge a certain universality of inelastic reactions and the regularity of all structures with $\sqrt{-t}$ instead of $-t$. (auth)

**1506** HARMONIC ANALYSIS ON THE TIMELIKE AND SPACELIKE HYPERBOLOIDS: APPLICATION TO INCLUSIVE REACTIONS. Pasupathy, J. (Tata Inst. of Fundamental Research, Bombay). Nuovo Cim.; 17A: No. 4, 681-697 (21 Oct 1973).

The timelike and spacelike hyperboloids are homogeneous spaces with respect to the Lorentz group, viz. the quotient spaces $SL_{2,c}/SU_2$ and $SL_{2,c}/SU_{1,1}$. The scattering amplitude possesses sufficient analyticity to continue from the timelike to the spacelike region. Starting from the harmonic analysis in the $SU_{1,1}$ basis for functions defined on the timelike sheet, with the aid of analytic continuation, the harmonic analysis is deduced for functions defined on the spacelike sheet in an $SU_2$ basis. The mathematical procedure is illustrated in detail by considering the three-body scattering amplitude, which is relevant for a discussion of inclusive reactions. (auth)

**1507 INVERSE PROBLEM WITH CONSTRAINTS.** Girardeau, M.D. (Institute of Theoretical Science and Department of Physics, University of Oregon, Eugene, Oregon 97403). Phys. Rev. C 8: No. 2, 834-834 (Aug 1973).

In a recent letter of the same title by Ernst, Monahan, Shakin, and Thaler, a procedure is presented for constructing a solution to the inverse problem with a set of prescribed wave functions. It is pointed out here that their procedure had in fact already been described in three previous publications, under the name of the method of "completely orthogonalized plane waves." (auth)

# PHYSICS (LOW-TEMPERATURE)

## Superfluidity

1508 NUMERICAL SOLUTION OF THE TRANSPORT EQUATION FOR SOUND PROPAGATION IN He II. Meier, P. F. (IBM Research Lab., Zurich); Beck, H. Phys. Rev., A; 8: No. 1, 569-572(Jul 1973).

Assuming an anomalous phonon dispersion, the velocity shift and the attenuation of ultrasound in liquid $^4$He below 0.5°K are calculated by a direct numerical solution of the Boltzmann equation for the phonon distribution function. In order to account for the hydrodynamic regime the collision invariants are treated separately. The results are in qualitative agreement with the experiments and show a nonmonotonic increase of the velocity shift as a function of the applied frequency, but they are different from an approximate solution using relaxation times. The method developed to solve the Boltzmann equation can also be applied directly to calculate transport properties of phonons in solids. (auth)

1509 BOSE CONDENSATION OF FERMION COMPOSITES. Goldberg, A. (Univ. of California, Livermore); Puff, R. D. Phys. Rev. Lett.; 30: No. 18, 869-872(30 Apr 1973).

A simple theory of fermion pair composites is described and applied to the situation where, at low density, Bose condensation into the lowest self-consistent composite state takes place. (auth)

1510 SIZE EFFECTS IN HELIUM II BELOW 1°K. Haug, H. (Philips Research Lab., Eindhoven, Netherlands). J. Low Temp. Phys.; 12: No. 5/6, 479-490(Sep 1973).

The normal fluid density $\rho_n$ and the specific heat $c_V$ are calculated for helium II flowing through plane parallel slits and capillaries with a square profile at temperatures below 1°K. Both functions increase over their bulk values if the thermal phonon wavelength $\lambda$ becomes comparable to or larger than the smallest dimension d of the container. The asymptotic expansions which are obtained have an overlapping range of validity, and therefore describe $\rho_n$ and $c_V$ rather accurately for all values of $\lambda/d$. (auth)

1511 HEAT FLOW THROUGH SUPERFLUIDS $^4$He AT LOW TEMPERATURES. Eckstein, Y.; Landau, J.; Rosenbaum, R. L. (Technion-Israel Inst. of Tech., Haifa). J. Low Temp. Phys.; 12: No. 5/6, 589-593(Sep 1973).

The heat conductivity of superfluid $^4$He has been measured as a function of temperature between 0.1 and 0.7°K at different pressures between zero and 24 atm. The experiment gives direct evidence that the heat conductivity varies at $T^3$ at very low temperatures. (auth)

1512 THREE-PHONON VERTEX CORRECTIONS TO THE EXCITATION SPECTRUM AND LIQUID-STRUCTURE FUNCTION OF LIQUID $^4$He. Lee, D. K. (Univ. of Kansas, Lawrence). J. Low Temp. Phys.; 12: No. 5/6, 579-588(Sep 1973).

The energy spectrum of elementary excitations and the liquid-structure function of liquid $^4$He are calculated by means of the method of correlated basis functions in the approximation of second-order perturbation theory. The procedure is based on (i) the construction of phonon functions in terms of collective coordinates and the optimum Bijl–Dingle–Jastrow type of ground-state wave function and (ii) the evaluation of leading correction terms to the Bijl–Feynman excitation spectrum, which are generated by two types of three-phonon vertices. Numerical results are obtained using the optimum liquid-structure function computed by Campbell and Feenberg in the paired-phonon analysis. (auth)

1513 USE OF SECOND SOUND TO INVESTIGATE THE INHOMOGENEOUS DENSITY DISTRIBUTION OF THE SUPERFLUID PART OF HELIUM II NEAR THE LAMBDA POINT. Ginzburg, V. L.; Sobyanin, A. A. (Lebedev Inst. of Physics, Moscow). JETP Lett. (USSR) (Engl. Transl.); 17: No. 12, 483-485(20 Jun 1973).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 17: No. 12, 698-702(20 Jun 1973).

One can hope to investigate the density distribution of the superfluid part of helium II near the $\lambda$ point by "sounding" the helium (in particular, the boundary between helium I and helium II in a gravitational or electric field) by means of second-sound waves. (auth)

1514 VORTEX ENERGY IN HELIUM II. Tsakadze, D. S. (Inst. of Physics, Tbilisi, USSR). Zh. Eksp. Teor. Fiz.; 65: No. 2, 617-621(Aug 1973). (In Russian).

The energy of a vortex at various temperatures is measured by the technique of accumulating small energy losses on multiple production of a known number of vortexes. (auth)

1515 EXTENDED JASTROW FUNCTIONS. Campbell, C. E. (Stanford Univ., CA). Phys. Lett.; 44A: No. 7, 471-473(13 Aug 1973).

The ground state wave function, $\psi_0$, of a many-boson system is written as a generalization of the Jastrow function. The Schrödinger equation is replaced by coupled equations for $\ln\psi_0$, which are solved iteratively. Preliminary results are given for liquid $^4$He. (auth)

1516 He II FILM FLOW OVER POLARIZED MEDIA. Wagner, F. (Univ., Munich). Phys. Lett.; 44A: No. 7, 489-490(13 Aug 1973).

Film flow measurements over ferroelectric KDP and polarized $PVF_2$ are reported. Both for outflow and inflow measurements the film flow does not show the phenomena which were recently reported by Esel'son et al. for film flow over perspex. (auth)

1517 EXPERIMENTAL PROOF THAT A MOVING HE II FILM CAN BE THINNER THAN A STATIC FILM. Van Spronsen, E.; Verbeek, H. J.; De Bruyn Ouboter, R.; Taconis, K. W.; Van Beelen, H. (State Univ., Leiden). Phys. Lett.; 45A: No. 1, 49-50(27 Aug 1973).

It is shown that under certain experimental conditions it is possible to detect a reduction in film thickness of a moving He II film in quantitative agreement with the prediction of Kontorovich. (auth)

1518 LONG-RANGE DISTORTIONS IN AN ANISOTROPIC SUPERFLUID. De Gennes, P. G. (College de France, Paris). Phys. Lett.; 44A: No. 4, 271-272(18 Jun 1973).

The distortions of an Anderson–Morel (AM) phase in terms of Ginzburg–Landau equations are discussed. We expect (a) a new type of singular line ("disgyration") (b) an anisotropic velocity for second and fourth sound (c) orbital spin waves elliptically polarized even in the absence of dipolar couplings. (auth)

1519 SPECTRUM OF SPONTANEOUS LIGHT SCATTERING FROM A SUPERFLUID LIQUID SURFACE. Bozhkov, A. I. (Lebedev Inst. of Physics, Moscow). Phys. Lett.; 44A: No. 4, 251-252(18 Jun 1973).

An expression for the spectral intensity of light scattered from the thermal fluctuations of free superfluid liquid surface is suggested. (auth)

1520 GINZBURG–LANDAU APPROACH TO $L \neq 0$ PAIRING. Mermin, N.D.; Stare, C. (Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, New York, 14850). Phys. Rev. Lett. 30: No. 22, 1135-1138 (28 May 1973).

By comparing the predictions of the weak–coupling BCS theory with a general Ginzburg–Landau approach, we show that the weak–coupling model may give a qualitatively incorrect description of pairing with $L \neq 0$. Specific examples of the errors the weak–coupling model leads to are described for d– and p–wave pairing. In the latter case the general Ginzburg–Landau approach has structure enough to account for the current discrepancies between the weak–coupling predictions and the observed behavior of the low–temperature transition in liquid $He_3$. (auth)

1521 ATTENUATION OF ZERO SOUND IN LIQUID $^3$He: A PROBE OF SUPERFLUID PAIRING. Wölfle, P. (Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, New York, 14850). Phys. Rev. Lett. 30: No. 23, 1169-1172 (4 June 1973).

It is shown that the anomalous zero-sound attenuation at the transition "A" observed recently in liquid $^3$He at about 2.7 mK can be understood by postulating pairing in a state of odd relative angular momentum. The attenuation is found to depend strongly on the angular variation and orientation of the gap parameter, providing information on the precise nature of the pairing. It is concluded that (1) Balian–Werthamer p–wave pairing can be ruled out, and (2) Anderson–Morel p–wave pairing is possible. (auth)

1522 PHENOMENOLOGICAL THEORY OF COLLISIONLESS SUPERFLUID $^3$He. Putterman, S.J. (Physics Department, University of California, Los Angeles, California, 90024). Phys. Rev. Lett. 30: No. 23, 1165-1169 (4 June 1973).

According to a phenomenological theory of collisionless superfluid $^3$He, the velocity of high–frequency sound should show a transition from zero– to first–sound velocities as the superfluid fraction $\rho_s/\rho$ is increased. From the experimental observations of this behavior by Paulson, Johnson, and Wheatley, the order parameter $\rho_s/\rho$ can be determined for $^3$He II. (auth)

1523 MEASUREMENT OF ROTON ENERGIES AND LINEWIDTHS IN $He^3$-$He^4$ SOLUTIONS. Woerner, R.L.; Rockwell, D.A.; Greytak, T.J. (Department of Physics, Center for Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts, 02139). Phys. Rev. Lett. 30: No. 22, 1114-1116 (28 May 1973).

Using Raman scattering from rotons in liquid $He^3$–$He^4$ solutions for $He^3$ concentrations $0 \leq X \leq 0.11$ at $T = 0.60°K$, we have measured the two-roton energy and linewidth. Our measurements indicate no change in the single-roton energy as a function of concentration, whereas the single-roton linewidth increases nonlinearly with X. (auth)

1524 ION CURRENTS IN TURBULENT COUNTERFLOW OF He II. Ashton, R. A.; Northby, J. A. (Department of Physics, University of Rhode Island, Kingston, Rhode Island, 02881). Phys. Rev. Lett. 30: No. 22, 1119-1122 (28 May 1973).

We report measurements of the attenuation of negative-ion currents in turbulent counterflow, as a function of the heat current, $\dot{q}$, and temperature. The dependence of the attenuation on $\dot{q}$ is well explained by present models of the turbulent state. The magnitude of the effect is in reasonable agreement with Vinen's original model, but disagrees with a modified version recently introduced by Sitton and Moss. (auth)

1525 ONSET FOR SUPERFLUID FLOW IN $He^4$ FILMS ON A VARIETY OF SUBSTRATES. Sabisky, E.S.; Anderson, C.H. (RCA Laboratories, Princeton, New Jersey, 08540). Phys. Rev. Lett. 30: No. 22, 1122-1125 (28 May 1973).

The onset of superfluid flow in $He^4$ films was measured between 1.37 and 2.13 K on substrates of NaF, $CaF_2$, $SiO_2$, Si, and Grafoil. Values of the Van der Waals constant of 19, 26, and 65 K were obtained for NaF, $SiO_2$, and Grafoil, respectively. In addition, a precise measurement of the critical thickness of the liquid–helium film was obtained, taking into account a small correction for the influence of the substrate. (auth)

1526 PHONON AND ROTON PROPAGATION IN He II UNDER PRESSURE. Dynes, R.C.; Narayanamurti, V.; Andres, K. (Bell Laboratories, Murray Hill, New Jersey, 07974). Phys. Rev. Lett. 30: No. 22, 1129-1132 (28 May 1973).

We have studied the transition from second sound to ballistic phonon flow in He II up to pressures of 24 bar. At saturated vapor pressure the phonon–phonon scattering rate $\tau_{pp}^{-1} \cong 1.7 \times 10^6 T^3$ sec$^{-1}$ for $T < 0.6$ K. At 24 bar, $\tau_{pp}^{-1} < 8 \times 10^4$ sec$^{-1}$ for $T < 0.7$ K. The phonon–roton scattering rate $\tau_{pr}^{-1}$ is $\approx 10^6$ sec$^{-1}$ at 0.75 K and almost pressure independent. At 24 bar between 0.4 and 0.7 K, in addition to ballistic phonons, we observe a second pulse traveling at 16 m/sec, which we believe is the propagation of interacting rotons. (auth)

1527 ANISOTROPIC SUPERFLUIDITY IN $^3$He: A POSSIBLE INTERPRETATION OF ITS STABILITY AS A SPIN–FLUCTUATION EFFECT. Anderson, P.W.; Brinkman, W.F. (Bell Telephone Laboratories, Murray Hill, New Jersey, 07974). Phys. Rev. Lett. 30: No. 22, 1108-1111 (28 May 1973).

It is proposed that the paramagnon effects which enhance $T_c$ for triplet pairing in $He^3$ are also important in selecting the particular component of the triplet p-wave state observed. It is found that the component favored is the original Anderson–Morel state. (auth)

1528 TWO-ROTON RAMAN SCATTERING IN $^3$He–$^4$He SOLUTIONS. Surko, C.M.; Slusher, R.E. (Bell Laboratories, Murray Hill, New Jersey, 07974). Phys. Rev. Lett. 30: No. 22, 1111-1114 (28 May 1973).

The two-roton Raman spectra of superfluid solutions of $He^3$ and $He^4$ are measured at a temperature of 1.3 K for molar concentrations of $He^3$ up to 31%. At 31% $He^3$ concentration, the shift in the roton energy is inferred from these spectra to be $+0.3 \pm 0.5$ K, in striking contrast to the –3.5–K shift inferred from previous measurements of normal–fluid density. The width of the two–roton peak is resolved and is a measure of the $He^3$–roton interaction. (auth)

1529 PHONONS AND PHASE TRANSITIONS OF HELIUM. Mattis, D.C.; Landovitz, L.F. (Belfer Graduate School of Science, Yeshiva University, New York, New York, 10033). Phys. Rev. Lett. 30: No. 24, 1196-1199 (11 June 1973).

We find a new collective shear–wave–like mode above $T_\lambda$, merging with the longitudinal acoustic mode at a higher critical temperature. The speed of the new sound wave is predicted to vanish near $T_\lambda$ as $s \propto (T - T_\lambda)^{1/2}$. (auth)

## Superconductivity

*Refer also to abstracts 234, 996, and 2307.*

1530 PHONON DAMPING IN $Nb_3Sn$. Bjelis, A.; Barisic, S. (Inst. of Physics, Zagreb). Fizika (Zagreb); 5: No. 2, 113-115 (May 1973).

Two physically different mechanisms have been proposed, in order to explain the ultrasonic attenuation in A-15 compounds. The first mechanism attributes this attenuation to the anharmonic, phonon–phonon coupling, the second to the linear electron–phonon coupling. This latter calculation uses the well known Labé-Friedel linear chain band model for the d-electrons in the A-15 structure and is applied to $V_3Si$. It is shown here that this latter mechanism alone cannot explain the three peak behavior observed in $Nb_3Sn$; this casts a doubt on the theory of the ultrasonic attenuation in $V_3Si$. (MHR)

1531 UPPER CRITICAL FIELDS AND CRITICAL CURRENTS OF SUPERCONDUCTING ZIRCONIUM–RHODIUM ALLOYS. Togano, K.; Tachikawa, K. (National Research Inst. for Metals, Tokyo). J. Less-Common Metals; 33: 275-282(1973).

The intermetallic compound $Zr_2Rh$ (tetragonal) is of considerable interest since it has a high superconducting transition temperature but is of non-cubic structure and does not contain a Va-group element. The superconducting upper critical field, $H_{c2}$, and critical current density, $J_c$, of Zr–Rh alloys containing 3, 14, and 33 at.% Rh were investigated. The Zr–33 at.% Rh specimen was composed of columnar crystals at $Zr_2Rh$ with [001] simple fiber texture and substructures. $H_{c2}$ of $Zr_2Rh$ is as high as 80 kOe at 4.2°K despite its relatively low normal state resistivity. $H_{c2}$ of $Zr_2Rh$ shows crystallographic anisotropy, i.e., higher $H_{c2}$ when the field is perpendicular to the columnar axis. $J_c$ of the Zr–14 and –33 at.% Rh specimens is related to their metallographic structures. (7 figures, 17 references) (auth)

1532 SUPERCONDUCTING FLUCTUATIONS IN COMPLEXES OF TETRACYANOQUINO-DIMETHANE AND STRUCTURAL IMPERFECTIONS. Thomas, J. M. (University Coll. of Wales, Aberystuyth, Eng.). Nature (London) Phys. Sci.; 244: No. 134, 56-57(23 Jul 1973).

It appears that certain types of organic conductors show indications of the approach of superconductivity at temperatures as high as 58K. Radical anion salts or charge-transfer complexes of tetracyanoquinodimethane, such as tetrathiofulvalene–tetracyanoquinodimethane (TTF : TCNQ), possess both the necessary conducting spine and the closely situated "sheath" of highly polarisable molecular groupings, such as TTF, along which, under appropriate circumstances, excitonic exchange could occur, and the question of the feasibility of attaining high temperature superconductivity with these compounds is discussed. Irrespective of whether the process is based on electron–phonon interaction or on exciton involvement, in order to achieve and sustain superconductivity in complexes of TCNQ it is necessary to preserve the integrity of both the one-dimensional segregated chains of $TCNQ^-$, or alternating $TCNQ^-$ and $TCNQ^0$, and the environment of closely positioned stacks of polarisable organic groupings. Ways in which both these prerequisites can be vitiated, and superconductivity probably rendered unattainable, by the presence of structural imperfections are pointed out. It has been reported that only three out of 70 crystals of TTF : TCNQ regularly showed superconducting fluctuations, demonstrating that the "physical" condition of the solid is crucial. It is suggested that the extremely erratic superconducting performance of samples of TTF : TCNQ may be traced to the presence of particular types of extended defects that are readily introduced into soft organic solids during growth and handling. According to Coleman and others (Solid State Commun. 12: 125(1973)) it seems likely that electron–phonon interaction, rather than excitonic involvement is dominant in the superconductivity of TTF : TCNQ, and it is also evident that cation polarisability in TCNQ charge-transfer complexes must be large for superconductivity to occur. Extreme microscopic perfection appears to be required to obtain superconducting fluctuations. (UK)

1533 CRITICAL MAGNETIC FIELDS OF GAPLESS SUPERCONDUCTING FILMS. Kraetzig, E. (Phillips Forschungslaboratorium, Hamburg). Phys. Status Solidi (a); 18: No. 2, K65-K67 (16 Aug 1973).

It is noted that superconducting films in perpendicular and parallel magnetic fields may show gapless superconductivity. Examples and data from experiments supporting gapless superconductivity are given. Data from a particular experiment involving Sn/Cr double layers show that for a Sn layer 1800 Å thick the temperature dependence of perpendicular and parallel magnetic fields is well described by derived equations presented in the discussion. (JRD)

1534 MAGNETIZATION STUDIES OF SUPERCONDUCTING Zr–Nb BINARY ALLOYS. Narasimhan, S. L.; Taggart, R.; Polonis, D. H. (Univ. of Washington, Seattle). Contract AT(45-1)-2225-T13. Scr. Met.; 7: No. 10, 1089-1095(Oct 1973).

Magnetization studies on quenched and aged Zr–20 and 15 at.% Nb reveal a definite correlation between microstructure and the magnetization behavior of beta-stabilized alloys in the superconducting state. It is confirmed that the omega phase contributes to the flux pinning characteristics of a given alloy, and it is shown that these characteristics are sensitive to the omega particle size and distribution. A modulated solid solution can be created by reverting the omega phase and the resulting structure is shown to have effective flux pinning characteristics. In this case, the pinning is dependent on the magnitude and distribution of the solute modulations. Magnetic instability was detected at discrete values of an externally imposed magnetic field that is applied in the persistent mode. These instabilities are reproducible and are independent of magnetic history. They can be eliminated by appropriate heat treatments that revert the structure of the omega phase while retaining composition fluctuations. At this time it is not possible to distinguish clearly between the separate roles of the coherency strains and the omega particles. The reversion experiments have made it clear that the solute-enriched zones contribute to flux pinning but are less effective than when combined with the omega particles. (auth)

**1535** NEUTRON DEPOLARIZATION IN SUPERCONDUCTING VANADIUM SINGLE CRYSTALS. Krueger, A.; Seidl, E.; Weber, H. W. (Oesterreichische Hochschule, Vienna). Phys. Lett.; 44A: No. 5, 365-367(2 Jul 1973).

The depolarization measured in the mixed state of superconducting vanadium single crystals differs considerably from the behavior observed in a large number of polycrystalline samples. In contrast to these samples, the depolarization does not disappear at the field $H^+$ but extends to larger fields according to the crystal orientation. A possible explanation seems to be the influence of the crystal anisotropy. (auth)

**1536** RESISTANCE DEPENDENCE OF PARACONDUCTIVITY IN INDIUM FILMS. Bhatnagar, A. K.; Gallardo, B. (St. John's Univ., Jamaica, NY). Phys. Lett.; 44A: No. 5, 357-358(2 Jul 1973).

Measurements of paraconductivity in indium films have been made as a function of resistance per square of the films. The resistive transitions are found to be broader than predicted by the Aslamazov–Larkin theory but are explainable by Maki–Thompson's theory. (auth)

**1537** ANGULAR DEPENDENCE OF THE EFFECTIVE PENETRATION DEPTH IN TYPE II FILMS. McLachlan, D. S. (Univ. of the Witwatersrand, Johannesburg). Phys. Lett.; 44A: No. 5, 343-344(2 Jul 1973).

Using a mutual inductance technique, measurements were made to establish whether anomalies in the penetration depth occur, due to the kinking of the fluxons, when the magnetic field is inclined to the surface of the film. (auth)

**1538** CORRELATION BETWEEN VORTEX LATTICE AND CRYSTAL LATTICE IN TYPE II SUPERCONDUCTORS DUE TO ELASTIC INTERACTION. Ullmaier, H.; Zeller, R.; Dederichs, P. H. (Kernforschungsanlage, Juelich, Ger.). Phys. Lett.; 44A: No. 5, 331-332(2 Jul 1973).

In an elastic anisotropic crystal, certain orientations of the vortex lattice with respect to the crystal lattice are favored due to the magneto-elastic strain fields of the vortex lattice. (auth)

**1539** MAGNETIZATION OF ELLIPSOIDS OF NONIDEAL SUPERCONDUCTORS. Melville, P. H. (Univ., Goettingen, Ger.). Phys. Status Solidi (a); 18: No. 2, 503-514(16 Aug 1973).

The magnetic properties of ellipsoids of reversible superconductors have been understood for a long time. Equations are developed to describe ellipsoids of superconductors where pinning centers are present. It is shown that ellipsoids of Type-II superconductors behave in much the same way as samples with no demagnetizing coefficient, except that the surface current depends on the amount of flux trapped in the ellipsoid. In the intermediate state of Type-I superconductors there is no interaction comparable with that between fluxons in Type-II superconductors, and thus the behavior is different. It is shown that in increasing field there exists a thin ring of normal material at the equator, and in decreasing field there is a thin layer of negative flux at the equator. (auth)

**1540** SUPERCONDUCTIVITY AND PHASE TRANSITIONS IN SINGLE-CRYSTAL AND POLYCRYSTAL $\alpha$–U AT HIGH PRESSURE. Smith, T. F. (Univ. of California, San Diego, La Jolla); Fisher, E. S. J. Low Temp. Phys.; 12: No. 5/6, 631-641(Sep 1973).

The superconducting transition temperature of single-crystal and polycrystal uranium has been determined as a function of hydrostatic pressure to 24 kbar. Although the general form of the $T_c(P)$ variation is similar for the two types of material, features are present in the detailed behavior for the single-crystal samples which are not found for polycrystal samples. These features are presumed to be associated with the first-order transitions observed at zero pressure. A low-temperature phase diagram was constructed and the electronic nature of the various phases is discussed. (auth)

**1541** CORRELATION BETWEEN ANISOTROPY IN THE NORMAL-STATE MASS RENORMALIZATION AND ANISOTROPY IN THE SUPERCONDUCTING ENERGY GAP FOR ZINC. Auluck, S. (Univ. of Chicago). J. Low Temp. Phys.; 12: No. 5/6, 601-629(Sep 1973).

A nonlocal pseudopotential model for the Fermi surface and band structure of zinc together with the cyclotron resonance data is used to calculate the orbital average of the normal-state mass renormalization $\lambda^{k}_{CR}$ for numerous cyclotron orbits on the Fermi surface of zinc. It is found that the mass renormalization $\lambda_k$ is constant for each sheet of the Fermi surface but that it varies from sheet to sheet. Using the Eliashberg equation, this anisotropy in $\lambda_k$ is correlated to anisotropy in the superconducting energy gap $\Delta_k$. For zinc three distinct energy gaps are predicted, in the ratio of 2.30 : 1.76 : 1.00, corresponding respectively to the lens, the monster, and the cap sheets of the Fermi surface. Experimental evidence for this anisotropy in $\Delta_k$ is provided by various measurements of the electronic properties in the superconducting state such as the low-temperature specific heat, microwave absorption, ultrasonic attenuation, effect of alloying on the critical temperature, and the temperature dependence of the critical field. It is shown that the results of these experiments are consistent with the predictions. (auth)

**1542** COHERENT POTENTIAL APPROXIMATION FOR NONMAGNETIC WEAK-COUPLING SUPERCONDUCTING ALLOYS. Lustfeld, H. (Univ., Hamburg). J. Low Temp. Phys.; 12: No. 5/6, 595-600(Sep 1973).

With the aid of the Nambu formalism the coherent potential approximation (CPA) is applied to superconducting binary alloys of arbitrary composition. It will be shown that an approximation in which the order parameter $\Delta$ does not depend on the space variable leads to a generalized Abrikosov relation, simplifying the CPA equations considerably. This relation yields the BCS equation for $T_c$, however, the density of states is determined by the CPA. (auth)

**1543** APPLICATION OF THE RENORMALIZATION GROUP TECHNIQUE TO THE PROBLEM OF PHASE TRANSITION IN ONE-DIMENSIONAL METALLIC SYSTEMS. II. Response Functions and the Ground-State Problem. Solyom, J. (Central Research Inst. for Physics, Budapest). J. Low Temp. Phys.; 12: No. 5/6, 547-558(Sep 1973).

The results of the preceding paper for the invariant coupling are used to calculate some response functions in a one-dimensional metallic system. Three generalized susceptibilities, characterizing the possible superconducting or antiferromagnetic behavior of the system and the appearance of density waves, are calculated by means of the Lie equations of the renormalization group. Due to the nonsingular behavior of the invariant couplings, the response functions can diverge at $\omega = 0$ only, and this singularity is of power-law type. Depending on the sign and relative value of the bare coupling constants, the model system tends to superconducting or antiferromagnetic order at $T = 0$. In certain cases the period of the system is doubled. (auth)

**1544** APPLICATION OF THE RENORMALIZATION GROUP TECHNIQUE TO THE PROBLEM OF PHASE TRANSITION IN ONE-DIMENSIONAL METALLIC SYSTEMS. I. Invariant Couplings, Vertex, and One-Particle Green's Function. Menyhard, N.; Solyom, J. (Central Research Inst. for Physics, Budapest). J. Low Temp. Phys.; 12: No. 5/6, 529-545(Sep 1973).

A one-dimensional system of electrons interacting via a BCS-type interaction is investigated by renormalization group techniques in two successive approximations at $T = 0$, keeping only a single energy variable $\omega$. The first approximation is equivalent to the summation of leading logarithmic terms carried out by Bychkov et al., and correspondingly the vertex function displays a singularity at a finite value of $\omega$. The second approximation accounts for the next leading logarithmic terms as well, and by this means the singularity is shown to be pushed down to $\omega = 0$. Due to important self-energy contributions, however, the invariant couplings behave differently and tend to a saturation value at $\omega = 0$. (auth)

**1545** PROXIMITY EFFECT IN SUPERCONDUCTORS: CALCULATION OF THE TRANSITION TEMPERATURE. Hong, K. M.; Jacobs, A. E. (Univ. of Toronto). J. Low Temp. Phys.; 12: No. 5/6, 519-527(Sep 1973).

The problem of the calculation of the transition temperature in the proximity effect is considered. From the variational principle of Silvert and Cooper a simpler variational principle is derived which is useful in obtaining a rapid numerical estimate of the transition temperature as well as the qualitative features of the solution. Approximate and exact solutions for the transition temperature and the order parameter are obtained in the clean limit, the geometry investigated being that of a superconducting sphere embedded in an infinite normal matrix. The results for the transition temperature do not display the unphysical behavior found in previous work in the clean limit and suggest that there is a critical radius for the sphere below which the sample is normal at all temperatures. The results for the order parameter show that the nonanalytic behavior discovered by Silvert and Cooper is a relatively small effect in the case investigated. (auth)

**1546** CRITICAL FIELD FOR SUPERCONDUCTIVITY AND LOW-TEMPERATURE NORMAL-STATE HEAT CAPACITY OF TUNGSTEN. Triplett, B. B.; Phillips, N. E.; Thorp, T. L.; Shirley, D. A.; Brewer, W. D. (Univ. of California, Berkeley). J. Low Temp. Phys.; 12: No. 5/6, 499-518(Sep 1973).

The critical magnetic field for superconductivity in tungsten was measured from 5.5 to 15 mK using a $\gamma$-ray anisotropy thermometer, and the heat capacity was measured between 0.35 and 25°K. Analysis of the data gives $H_0 = 1.237$ Oe for the 0°K critical field, $T_c = 16.0$ mK for the critical temperature, $\gamma = 1.008$ mJ/mole · K² for the coefficient of the electronic heat capacity, and $\Theta_0 = 383$°K for the 0°K Debye temperature. The measured values of the critical field $H_c$ are consistently higher than those reported by Black, Johnson, and Wheatley (BJW) on the CMN temperature scale, but the temperature dependence is similar. This discrepancy and the temperature dependence of $H_c$ suggest that both sets of $H_c$ data are affected by magnetic impurities. Use of the calorimetric $\gamma$ value permits an improved test of the CMN temperature scale with the very-low-temperature $H_c$ data obtained by BJW. (auth)

**1547** GIBBS FREE-ENERGY BARRIER AGAINST IRREVERSIBLE MAGNETIC FLUX ENTRY INTO A SUPERCONDUCTOR. Clem, J. R. (Ames Lab., IA); Huebener, R. P.; Gallus, D. E. J. Low Temp. Phys.; 12: No. 5/6, 449-477(Sep 1973).

The Gibbs free-energy barrier against irreversible magnetic flux entry into a superconductor was calculated for a long cylinder with elliptical cross section which approximates a long, flat strip. The model is simplified to the two-dimensional case by assuming magnetic flux to enter in the form of a long, narrow, normal domain parallel to the axis of the cylinder. The following four contributions to the Gibbs free energy have been taken into account: (1) loss of condensation energy and gain of magnetic field energy inside the superconductor, (2) magnetic field energy outside the superconductor, (3) energy of interaction of the domain with an applied magnetic field, and (4) energy of interaction with an applied electrical transport current. Because of the Gibbs free-energy barrier, the critical magnetic field for entry of magnetic flux can be enhanced considerably above that calculated using Silsbee's rule. This enhancement is found to be proportional to the square root of the width of the superconducting cylinder. Important consequences of this are the enhancement of the critical current in a superconducting strip in zero magnetic field at which electrical resistance starts to appear and a corresponding modification of Silsbee's rule. These effects were demonstrated experimentally through measurements of the onset of the current-induced resistive state in a series of superconducting indium strips of different widths and thicknesses. The experimental results confirm the theoretical predictions. The Gibbs free-energy-barrier effect described here can be interpreted as a novel flux-pinning mechanism, which might be called edge pinning. (auth)

**1548** EVIDENCE FOR AN INTERMEDIATE STATE IN THE PRODUCTION OF ENERGETIC NEUTRAL EXCITATIONS IN He II. Mitchell, R. P.; Rayfield, G. W. (Univ. of Oregon, Eugene). J. Low Temp. Phys.; 12: No. 5/6, 439-447(Sep 1973).

It has been shown that energetic neutral excitations are produced when a tritium ($\beta^-$ emitter) source is immersed in He II. These neutrals have the same characteristics as those observed by Surko and Reif for a $^{210}$Po ($\alpha$ emitter) source. However, a strong electric field in the ionization region of the source is required in the tritium case to produce neutrals. Using this effect it is possible to produce pulses of neutrals and obtain information about their physical properties. A three-level decay scheme with an intermediate state is suggested to explain the experimental results. (auth)

**1549** SUPERCONDUCTIVE TRANSITION IN CADMIUM. Schooley, J. F. (National Bureau of Standards, Washington, DC). J. Low Temp. Phys.; 12: No. 5/6, 421-437(Sep 1973).

Mutual inductance measurements of the superconductive transitions occurring in single-crystal and polycrystalline cadmium samples in magnetic fields of $0-10^{-4}$T (0-1 G) are presented. The temperature at which the zero-field superconductive transition midpoints occur appears to be constant within ±0.2 mK for transitions narrower than 2 mK, but $T_c$ increases for broader transitions. The transitions exhibited both narrowing and hysteresis, the latter perhaps due to supercooling, in fields of a few tenths of a gauss. $T_c$ has been measured as $0.515 \pm 0.002_5$ K on the $T_{62}$ temperature scale. (auth)

**1550** ULTRASONIC-ATTENUATION DETERMINATION OF THE ANISOTROPIC ENERGY GAP IN SUPERCONDUCTING ZINC. Cleavelin, C. R. Lubbock, TX; Texas Tech Univ. (1973). 146p. University Microfilms Order No. 73-23,754.

Thesis (Ph. D.).

Measurements of the ultrasonic-attenuation in normal and superconducting high purity zinc single crystals have been conducted for longitudinal sound waves propagating in the [0001], $[10\bar{1}0]$, and $[11\bar{2}0]$ crystallographic directions. The ultrasound frequencies used in each of these crystallographic directions are: [0001]-10, 30, and 50 MHz; $[10\bar{1}0]$-10, 30, 50, and 70 MHz; $[11\bar{2}0]$-10, 30, 50, 70, 90, 110, 120, 130, 150, and 170 MHz. Analysis of the data has been presented using the Bardeen, Cooper, and Schrieffer theory of superconductivity. Incorporated into the analysis has been the allowance for anisotropy in the energy gap, frequency dependence of the energy gap and the total electronic attenuation, and the possibility of multiple energy gaps. The analysis indicates that the energy gap is highly anisotropic. The analysis also indicates that the effective energy gap in the $[11\bar{2}0]$ crystallographic direction is frequency dependent. The existence of multiple energy gaps in zinc is only slightly suggested by some of the measurements at the lower ultrasound frequencies. (Diss. Abstr. Int., B)

**1551** MEASUREMENTS OF THE COMPLEX IMPEDANCE OF ONE-DIMENSIONAL TIN WHISKER CRYSTALS NEAR THE SUPERCONDUCTING TRANSITION TEMPERATURE. Miller, J. R. Charlottesville, VA; Univ. of Virginia (1973). 84p. University Microfilms Order No. 73-24,973.

Thesis (Ph. D.).

An extensive experimental study of fluctuation effects in the complex ac impedance $Z_W(\omega,T)$ of one-dimensional tin whisker crystals near the superconducting transition temperature $T_c$ is described. The behavior of $Z_W(\omega,T)$ in $\langle 001 \rangle$ whiskers with cross-sectional areas $2 \times 10^{-10}-3 \times 10^{-9}$ cm² was measured at 60 MHz, 1 kHz, and dc from below $T_c$ in the mean field temperature range up through $T_c$ and slightly above. Paraconductivity data were not obtained. By correlating high frequency reactance data with resistance data from dc or low-frequency ac measurements, a more stringent test was made of the theory of fluctuation effects than is possible with dc measurements alone. It is found that the theory of Langer and Ambegaokar (LA) as completed by McCumber and Halperin (MH) for the onset of resistance is inconsistent with the results unless the La barrier height is reduced by a factor of approximately 0.55. If this is done, La-MH prediction agrees with our resistance data over the full whisker size range. The MH result for the onset of fluctuation effects in the reactance agrees with our data without modification. No theory exists which can explain the behavior of $Z_W(\omega,T)$ as T passes through $T_c$. The data is presented in a form to facilitate comparison with future theories. Reactance data in the mean field region yield a direct measurement of the penetration depth. An interesting size effect in this quantity is found, and a new value is reported for the London penetration depth in pure tin, $\lambda_L = 289 \pm 20$ Å. (Diss. Abstr. Int., B)

**1552** EFFECTS OF DILUTE ALLOYING ON THE ELASTIC CONSTANTS AND SUPERCONDUCTING ENERGY GAP IN THALLIUM. Crews, R. M. Houston, TX; Univ. of Houston (1973). 121p. University Microfilms Order No. 73-22,898.

Thesis (Ph. D.).

Velocity of sound and ultrasonic attenuation measurements were made on two pure and two doped samples of thallium. One of the pure samples was grown from the melt and the other by strain-anneal and called the unmelted sample. All samples were single crystals and all measurements were made using 15 MHz longitudinal sound pulses. The doped samples contained $\frac{1}{4}$ at.% and $\frac{1}{8}$ at.% tin as an impurity. The elastic constants appropriate for a longitudinal wave travelling in the c axis direction ($C_{33}$) were measured as a function of temperature and impurity. The measured elastic constants vary between $4.8 \times 10^{11}$ dynes/cm² for the pure unmelted sample at 500K to $6.5 \times 10^{11}$ dynes/cm² for the $\frac{1}{4}$ at.% sample at 4.2K. The elastic constants were calculated from velocity of sound data. A simple band structure model based on the two plane wave approximation is presented and the band structure elastic constants calculated. The model gives relative changes in the elastic constants as a function of temperature and/or impurity. A term representing the electrostatic energy of the crystal is substracted from the measured elastic constants and the result is compared to values predicted by the model. Band structure elastic constants range from $-14.6 \times 10^{11}$ dynes/cm² for the pure unmelted sample at 500K to $-15.27 \times 10^{11}$ dynes/cm² for the $\frac{1}{4}$ at.% sample at 4.2K. Finally, the limiting superconducting energy gap is measured as a function of sample impurity. The values obtained are $2\Delta(0) = 4.6K_BT_C$, $4.6K_BT_C$, $4.0K_BT_C$, and $3.3-3.6K_BT_C$ for the pure melted sample, pure unmelted sample, $\frac{1}{8}$ at.% sample, and $\frac{1}{4}$ at.% sample respectively. The value of $2\Delta(0)$ is observed to approach the BCS value of $3.5K_BT_C$ as the doping level is increased. (Diss. Abstr. Int., B)

**1553** ACOUSTOELECTRIC AND THERMOELECTRIC EFFECTS IN SUPERCONDUCTORS. Gal'perin, Yu. M.; Gurevich, V. L.; Kozub, V. I. (Ioffe Physical-Technical Inst., Leningrad).

JETP Lett. (USSR) (Engl. Transl.); 17: No. 12, 476-477(20 Jun 1973).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 17: No. 12, 687-690(20 Jun 1973).

It is shown that a phase difference of the ordering parameter is produced on the boundaries of a superconductor through which sound propagates or in which a temperature gradient exists. This difference is proportional to the difference between the sound intensities or the temperature difference, and can be measured in a superconducting interferometer. (auth)

**1554** POSSIBLE METHODS OF PLASTICITY CHANGE IN A SUPERCONDUCTING TRANSITION. Indenbom, V. L.; Estrin, Yu. Z. (Crystallography Inst., Moscow). JETP Lett. (USSR) (Engl. Transl.); 17: No. 12, 468-470(20 Jun 1973).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 17: No. 12, 675-678(20 Jun 1973).

Dynamic mechanisms of weakening in N−S transitions, due to the decrease of electron dragging of dislocations, and quasistatic mechanisms due to the inhomogeneity of the dislocation structure, are discussed. (auth)

**1555** THERMO-ELECTROSTATIC EFFECTS IN SUPERCONDUCTORS. De Waele, A. T. A. M.; De Bruyn Ouboter, R.; Pipes, P. B. (State Univ., Leiden). Physica; 65: No. 3, 587-605(1 May 1973).

Irreversible thermodynamics shows that there is an electrostatic voltage difference in a superconductor if a temperature difference is established across the ends. This voltage difference is due to a difference in the chemical potential $\mu$ of the conduction electrons. It is sometimes considered as the analog of the fountain pressure in helium II. It is equal to the bulk contribution to the temperature dependence of the work function W. An experiment is described in which the W-T dependences of niobium and lead are measured. The order of magnitude of dW/dT in the liquid-helium temperature range is $10\mu$V/K for Nb and $0.5\mu$V/K for Pb. The magnitude of the signal is as yet not well understood. Contrary to the fountain pressure in helium II the $\mu$-T dependence cannot simply be written in terms of the entropy per conduction electron. The $\mu$-T dependence seems to be dominated by terms due to the temperature dependence of the lattice constants, the metal-surface dipole layer and the Fermi surface. (auth)

**1556** THEORY OF RAMAN SCATTERING OF LIGHT IN SUPERCONDUCTORS. Abrikovsov, A. A.; Genkin, V. M. (Inst. of Theoretical Physics, Moscow). Zh. Eksp. Teor. Fiz.; 65: No. 2, 842-847(Aug 1973). (In Russian).

The alterations in the theory of Raman scattering of light in superconductors which appear as a result of taking into account the anisotropy of the electronic spectrum and the electron coulomb interaction are considered. It is shown that the scattering probability is strongly anisotropic and varies from $10^{-3}$ up to a value exceeding by several times that previously obtained for an isotropic model and without account of coulomb interaction. (auth)

**1557** ANOMALOUS TUNNELING INTO MAGNETICALLY ORDERED DILUTE ALLOYS INDUCED INTO THE SUPERCONDUCTING STATE. Chaikin, P. M. (Univ. of California, Los Angeles); Mihalisin, T. W. Phys. Lett.; 44A: No. 7, 474-476 (13 Aug 1973).

Unusual tunneling characteristics for junctions consisting of Al, oxide and magnetic alloys, which are backed by Pb, are presented. The Pb induces the alloys to be superconducting. The alloys studied are 1500 ppm Fe in Au and 1200 ppm Co in Pd. (auth)

**1558** RE-ENTRANT CRITICAL FIELD BEHAVIOR IN $Gd_xTh_{1-x}Ru_2$: CORRELATION WITH EPR. Davidov, D.; Rettori, C.; Baberschke, K.; Orbach, R. (Univ. of California, Los Angeles). Phys. Lett.; 45A: No. 2, 163-164(10 Sep 1973).

The correlation between re-entrant critical field behavior and the EPR g shift enables us to estimate the conduction electron spin orbit scattering for the system $Gd_xTh_{1-x}Ru_2$. (auth)

**1559** CORRELATION BETWEEN ELECTRON SPIN RESONANCE AND SUPERCONDUCTIVITY IN $Gd_xB_{1-x}Ru_2$ (B = Th, Ce, La). Davidov, D.; Rettori, C.; Baberschke, K.; Chock, E. P.; Orbach, R. (Univ. of California, Los Angeles). Phys. Lett.; 45A: No. 2, 161-162(10 Sep 1973).

Correlation between EPR and superconductivity in $Gd_xB_{1-x}Ru_2$ (B = Th, Ce, La) enables us to interpret the behavior of the superconducting transition temperature as a function of Gd concentration in these cubic intermetallic compounds. (auth)

**1560** EFFECT OF HYDRIDING PRESSURE ON SUPERCONDUCTING TRANSITION TEMPERATURE OF PALLADIUM HYDRIDE AND PALLADIUM RHODIUM HYDRIDE. Schirber, J. E. (Sandia Labs., Albuquerque, NM). Phys. Lett.; 45A: No. 2, 141-142(10 Sep 1973).

A strong dependence of the superconducting transition temperature $T_c$ of Pd and RhPd hydrides on the hydriding pressure at ~24°C was observed. $H_2$ pressures to ~5 kbar were found to raise $T_c$ to over 7°K in PdH. (auth)

**1561** FEASIBILITY OF HIGH TEMPERATURE SUPERCONDUCTIVITY IN NONEQUILIBRIUM SYSTEMS WITH REPULSION. Galitskii, V. M.; Elesin, V. F.; Kopaev, Yu. V. (Lebedev Inst. of Physics, Moscow). JETP Lett. (USSR) (Engl. Transl.); 18: No. 1, 27-28(5 Jul 1973).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 18: No. 1, 50-53(5 Jul 1973).

The feasibility of obtaining high-temperature superconductivity in nonequilibrium systems with repulsion between the electrons is examined. It is shown that in a metal containing a source that transfers electrons with energies lower than the Fermi energy to a state with higher energy it is possible to obtain, besides the trivial solution with zero gap, also a new solution with nonzero superconducting gap and inverted electron distribution. (auth)

**1562** STUDY OF EFFECTIVE PHONON SPECTRUM OF SUPERCONDUCTING $Nb_3Sn$ ALLOY BY ELECTRON TUNNELING. Vedeneev, S. I.; Golovashkin, A. I.; Motulevich, G. P. (Lebedev Inst. of Physics, Moscow). Phys. Lett.; 45A: No. 2, 103-104 (10 Sep 1973).

Investigations of $Nb_3Sn/Al_2O_3/Nb_3Sn$ and $Nb_3Sn/I/Pb$ tunnel junctions (I is $Al_2O_3$ or an oxide of $Nb_3Sn$) are reported in the voltage region up to 34 mV, at 4.2°K. Both the differential conductance and the second derivative of tunnel current against voltage were measured for the tunnel junctions. In the measurements ten samples of $Nb_3Sn$ (0.5 to $0.7\mu$ thickness) with the critical temperature $T_c$ = 17.6 to 18.1°K were used. (MHR)

**1563** TEMPERATURE DEPENDENCE OF RATIO, $H_{c2\parallel}/H_{c2\perp}$, FOR $NbSe_2$. Muto, Y.; Toyota, N.; Noto, K.; Hoshi, A. (Tohoku Univ., Sendai). Phys. Lett.; 45A: No. 2, 99-100(10 Sep 1973).

It is found that the ratio $H_{c2\parallel}$ to $H_{c2\perp}$ is dependent on temperature for the superconducting dichalcogenide, $NbSe_2$. (auth)

**1564** INTERPHASE SURFACE ENERGY PARAMETER OF SUPERCONDUCTING LEAD IN THE TEMPERATURE RANGE FROM 4.7 TO 7.1 K. Aoki, R.; Kraegeloh, U.; Miyazaki, T.; Shinozaki, B. (Kyushu Univ., Fukuoka). Phys. Lett.; 45A: No. 2, 89-90(10 Sep 1973).

Regular layer patterns of the intermediate state in thin superconducting lead foils have been studied by shadow electron microscopy for temperatures between 4.7 K and 7.1 K. The interphase surface energy parameter $\Delta$ was estimated applying Landau's model to the observed intermediate state pattern. (auth)

**1565** SUPERCONDUCTIVITY IN THE TERNARY MOLYBDENUM SULFIDES. Fischer, O. (Dept. de Physique de la Matiere Condensee, Geneva); Odermatt, R.; Bongi, G.; Jones, H.; Chevrel, R.; Sergent, M. Phys. Lett.; 45A: No. 2, 87-88(10 Sep 1973).

Some characteristic properties of the ternary molybdenum sulfides are described. It is shown that one may increase the superconducting transition temperature several degrees by adding light elements to existing Mo−S superconductors. (auth)

**1566** FLUCTUATION CONDUCTIVITY AND DIMENSIONALITY CHANGE IN SUPERCONDUCTING FILMS OF INTERMEDIATE THICKNESS. Aoi, K. (Institut Max von Laue−Paul Langevin, Garching, Ger.). Phys. Lett.; 44A: No. 4, 267-268(18 Jun 1973).

It is shown that a change of the effective dimensionality of a superconducting film of intermediate thickness can occur in a perpendicular magnetic field. As the field is increased from the upper critical field $H_{c\perp}$ for a fixed temperature, the dimensionality for the superconducting fluctuations changes from zero to one dimension. An interpolation formula for the fluctuation conductivity for such cases is derived. (auth)

**1567** METHOD FOR MEASUREMENT OF SPECIFIC HEAT BY INCREASING AND DECREASING TEMPERATURE. Ehrat, R.; Rinderer, L. (Univ., Lausanne, Switzerland). Z. Angew. Math. Phys.; 24: No. 2, 225-247(1973). (In French).

It is difficult to obtain equilibrium values of entropy from measured thermal quantities, for superconductors in a mixed phase, because of irreversible behavior generally observed in real samples. It is possible to reduce, even suppress, the uncertainty arising from interpretation of results, if entropy variations are determined not only for increasing magnetic field and temperature, but also for decreasing field and temperature. A method to measure the specific heat is described, which is valid for T < ~10°K. As in the case of the heat burst method, the advantage is that the determination occurs from quasi-equilibrium states in temperature of the system. In addition, a heat leak allows us also to make measurements with decreasing temperature, as in the cooling curve method. The theoretical model corresponding to the experimental arrangement is thoroughly analysed from a mathematical point of view. Systematic errors, arising from the method itself, may be reduced to less than 0.5% and temperature variations of a few millidegrees can still be measured with a precision of the order of 1%. This procedure is then well adapted to the detailed study of superconducting phase transitions. (auth)

**1568** OBSERVATION OF THE MIXED STATE IN FILMS OF TYPE-I SUPERCONDUCTORS (Pb). Boersch, H.; Kunze, U.; Lischke, B.; Rodewald, W. (Technische Univ., Berlin). Phys. Lett.; 44A: No. 4, 273-274(18 Jun 1973).

The magnetic structures of the mixed state were observed in high purity films of a type I superconductor (lead). The flux-line-lattice structure is disturbed by pinning-effects. (auth)

**1569** PRESSURE AND IONIC MASS DEPENDENCE OF THE SUPERCONDUCTING TRANSITION TEMPERATURE FOR SIMPLE METALS: A PSEUDOPOTENTIAL CALCULATION. Bose, G. (Indian Inst. of Tech., Delhi); Gupta, H. C. Indian J. Phys.; 47: No. 6, 380-382(Jun 1973).

Using the modified potential, the pressure dependence of the superconducting transition temperature of three simple metals, Li, Al, and Pb and its ionic mass dependence for the last two metals were investigated. The results are found to be in fair agreement with the experiments and with the values calculated by other workers. (MHR)

**1570** TRICRITICAL POINTS OF THIN SUPERCONDUCTING FILMS. Goldman, A.M. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota, 55455). Phys. Rev. Lett. 30: No. 21, 1038-1041 (21 May 1973).

A similarity between the phase diagrams of systems which are believed to exhibit tricritical points and the phase diagram of the transition to the superconducting state of a thin film in a uniform magnetic field suggests the existence of a tricritical point in the latter system. The superconducting case is of interest because the field thermodynamically conjugate to the order parameter can be realized physically. The conjugate field plays an important role in models of the tricritical point but has been believed to be unphysical in systems studied thus far. (auth)

**1571** MICROSCOPIC INVESTIGATION OF THE COEXISTENCE OF SUPERCONDUCTIVITY AND MAGNETISM. Steiner, P.; Grumprecht, D.; Hüfner, S. (Fachbereich Physik, Freie Universität Berlin, Berlin–Dahlem, Germany). Phys. Rev. Lett. 30: No. 22, 1132-1135 (28 May 1973).

Mössbauer–effect measurements have been performed on the alloy system $Eu_xLa_{1-x}$ showing that for a sample with $x=1.2\%$ there is a transition to a magnetically ordered state at $660\pm25$ mK. The same sample shows a superconducting transition temperature of $T_s=2.15(10)$ K. (auth)

**1572** THEORY OF ELECTRON–SPIN RESONANCE IN GAPLESS SUPERCONDUCTORS. Maki, K. (Department of Physics, University of California, Los Angeles, California 90024). Phys. Rev. B 8: No. 1, 191-199 (1 July 1973).

The transverse dynamic spin susceptibility for conduction electrons in dirty gapless superconductors, in particular, in the vortex state of type–II superconductors, is calculated. It is shown that in the gapless region the dynamic susceptibility consists of two terms, the regular term and the anomalous term. In the low–frequency region of experimental interest, the regular term reduces to the static spin susceptibility, which is determined, for example, by the Knight–shift measurement in superconductors, while the anomalous term has a pole, which is associated with a resonance of the spin of conduction electrons. The resonance linewidth $T_2^{-1}$ is determined from the imaginary part of the resonance frequency. It is shown that $T_2^{-1}$ behaves quite differently in the superconducting state depending on whether $T_2^{-1}$ in the normal state is primarily due to the spin–orbit scattering or due to the exchange scattering from the magnetic impurities. (auth)

**1573** MAGNETIC MEASUREMENTS ON STRONG-COUPLING $Pb_{1-2x}Bi_xTl_x$ AND Pb-In SUPERCONDUCTING ALLOYS. Fearday, J.H.; Rollins, R.W. (Department of Physics, Ohio University, Athens, Ohio 45701). Phys. Rev. B 8: No. 1, 162-168 (1 July 1973).

Measurements are presented of the generalized Ginzburg–Landau parameter $\kappa_2(T)$ and the bulk upper–critical field $H_{c2}(T)$ as a function of temperature T near the critical temperature in $Pb_{1-2x}Bi_xTl_x$, where x = 0.015, 0.05, 0.10, and 0.15, and of $H_{c2}(T)$ in $Pb_{1-y}In_y$, where y = 0.018, 0.53, 0.087, and 0.167. These results, and previous measurements of $\kappa_2$ in Pb–In by Farrell et al., which are in disagreement with weak–coupling theories are found to be in ageement with calculations by Eilenberger and Ambegaokar and by Usadel which include both strong–coupling and electron–mean–free–path effects. (auth)

## Equipment and Devices

*Refer also to abstract 2372.*

**1574** (BNL-18186) DESIGN OF A COAXIAL $TE_{011}$ CAVITY FOR MEASUREMENTS OF METALLURGICAL PROPERTIES AND SUPERCONDUCTING rf BREAKDOWN FIELDS ON THE SAME SAMPLE. Bauer, W.; Giordano, S.; Luhman, T. (Brookhaven National Lab., Upton, N. Y.). 26 Jun 1973. 15p. Dep. NTIS $3.00.

A $TE_{011}$ coaxial cavity is described, where the center conductor is designed as a removable sample. The samples can be used for measurements of rf breakdown fields as well as metallurgical properties. Some of the proposed investigations are outlined. (auth)

**1575** SUPERCONDUCTING MAGNET CELL. Bogner, G.; Kuckuck, H. (to Siemens Aktiengesellschaft). US Patent 3,748,615. 24 Jul 1973. Priority date 7 May 1968, F. R. Germany. 4p.

A superconducting magnet coil is described wherein a superconductor is arranged in several winding layers and channels admitting a coolant, which are formed by cooling strips, are between the winding layers. The superconducting magnet coil is characterized in that the height of the cooling channels is approximately 0.1 to 0.2 mm. (auth)

**1576** HIGH ACCURACY POTENTIOMETERS FOR USE WITH TEN MILLIVOLT JOSEPHSON DEVICES. I. DOUBLE SERIES–PARALLEL EXCHANGE COMPARATOR. Finnegan, T.F.; Denenstein, A. (Department of Physics and Laboratory for Research on the Structure of Matter, University of Pennsylvania, Philadelphia, Pennsylvania 19174). Rev. Sci. Instrum. 44: No. 8, 944-953 (Aug 1973).

High accuracy determinations of 2 e/h using the ac Josephson effect require correspondingly accurate measurements of small dc voltages. In the preliminary stages of a determination of 2 e/h with substantially improved accuracy, two different potentiometric instruments based on two independent principles of operation were designed and built. Both instruments were used in an extended series of 2 e/h measurements at the University of Pennsylvania and subsequently at the National Bureau of Standards where they have been used to realize the U. S. legal volt as recently redefined via the ac Josephson effect. One of these instruments is based on a modified series–parallel technique and is described in detail in this paper. After treating the general theory of the low resistance case, the design and construction of a portable self–checking instrument based on the double series–parallel exchange method is described. This series–parallel comparator (SPC), built to compare a Josephson device (10 mV) and a standard cell (1 V), was evaluated and tested in the course of determinations of 2 e/h with one standard deviation (1 $\sigma$) uncertainties of about 0.1 ppm. The sources of systematic uncertainty are discussed. The uncertainty attributable to the comparator alone is about 3 parts in $10^8$(1 $\sigma$). (auth)

**1577** THEORY OF PHOTON–ASSISTED TUNNELING IN SUPERCONDUCTING JUNCTIONS WITH ACTIVE BARRIER IMPURITIES. Sherman, R.D. (Physics Departmeht, University of Illinois, Urbana, Illinois 61801). Phys. Rev. B 8: No. 1, 132-137 (1 July 1973).

A model is proposed to theoretically study photon–assisted tunneling in superconducting junctions with active molecular impurities in the barrier. A simple calculation is performed to demonstrate the method. Temperature Green's functions are employed so that it is possible to include known results on strong–coupling superconductors while extending theory to include molecular–impurity effects. (auth)

# PHYSICS (NUCLEAR)

## Neutron Interactions with Matter

*Refer also to abstracts 1722 and 1940.*

**1578** (CEA-N-1607) FITTING OF A STATISTICAL LAW TO THE SPATIAL DISTRIBUTION OF SLOWING-DOWN NEUTRONS. Buxerolle, M.; Zaborowski, H. L. (Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires). Feb 1973. 32p. (In French). Dep. NTIS (U.S. Sales Only) $3.75.

The case of a point source in an infinite medium is considered. A log normal law can be used to describe the $R^2 \cdot q(R)$ distribution, q(R) being the neutron density at a radial distance R. The model correctly explains the published experimental values for water at a distance of several centimeters from the source. It also enables the neutron age to be accurately calculated without difficulty. The assumption of a log-normal distribution is valid for other scattering media or source geometries. (FR)

**1579** (KFK-1725) HANDLING AND SERVICE PROGRAMS FOR THE KARLSRUHE NUCLEAR DATA FILE KEDAK. Part I. Management and Retrieval Programs. Krieg, B. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). Jun 1973. 54p. Dep. NTIS (U. S. Sales Only) $4.75.

In different parts of this report the computer programs developed in association with the Neutron Nuclear Data File KEDAK maintained in Karlsruhe are described. In this part the NDF program package for the retrieval of the data from KEDAK and the program system KEMA for updating the KEDAK library (e.g., for deletion, insertion, change of data records) are presented. These programs are written in FORTRAN IV and presuppose the direct access form of the KEDAK library as used in Karlsruhe. (auth)

**1580** (NIIAR-P-159) SNDIR CODE FOR NEUTRON FLUX MULTIGROUP CALCULATIONS IN ONE-DIMENSIONAL GEOMETRY WITH Sn METHOD. Zadvornykh, Z. V.; Yaroslavtseva, L. N. (Scientific Research Inst. of Atomic Reactors, Dimitrovgrad (USSR)). 1972. 46p. (In Russian). INIS.

A method and program for the multigroup calculation of the one-dimensional reactor in spherical, cylindrical, or flat geometry by means of the Carlson Sn method is described. The program is written in the ALPHA language and the amplification in the ALGOL-60 language. It is designed for a maximum number of 26 energy groups, a maximum number of 16 different zones, a maximum number of 146 calculation nodes, and a maximum approximation of $S_{40}$. The calculation formulas, the text of the program, and its block diagram are given. The calculation results are compared with the calculation results of other programs. (3 tables) (tr-auth)

**1581** NEUTRON FLUX DISTRIBUTION IN STRONGLY ABSORBING GASEOUS MEDIA. Bixby, W. W. Jr. College Park, MD; Univ. of Maryland (1973). 113p. University Microfilms Order No. 73-24,451.

Thesis (Ph. D.).

Experimental neutron flux distributions were obtained in a series of strongly absorbing gaseous media. Measurements were made in pure $CO_2$ and mixtures of $BF_3$ and $CO_2$ resulting in $\Sigma_s/\Sigma_c$ ratios ranging from 1200, for nearly pure $CO_2$ at 0 psig, to .02 for 74% $BF_3$–26% $CO_2$ at 42 psig. The small size of the cylindrical containment vessel, from a neutronic standpoint, resulted in the measured values being strongly influenced by axial and transverse leakage. To generalize the experimental results, the assumption was made that neutron losses due to leakage and absorption were separable. The mathematical result of this assumption was the absorptive function, which is characteristic of the distribution in a semi-infinite purely absorbing medium. The experimental results were compared with existing calculational models before and after separation. Before separation, comparison was made with an X-Y geometry transport theory code–TWOTRAN. The predominate transverse leakage term was accounted for through an inputted buckling height chosen to correct for the geometric differences arising from the absence of an accurate R–Z geometry code. Comparison of calculated and experimental results indicated: (1) a strong dependence on the energy spectrum of the source flux, (2) an underestimation of the leakage losses in cases where the mean free path of mixture was larger than the tank dimensions and (3) an overestimation of the leakage in cases where the mean free path of the mixture was comparable to the tank dimensions. A comparison of the absorptive function was made with transport theory formulations in purely absorbing media. Agreement between experimental and calculated results was achieved by assuming that the angular distribution of the source flux was strictly monodirectional as opposed to purely isotropic. These calculations were also shown to be sensitive to the energy spectrum used to calculate the source. (Diss. Abstr. Int., B)

**1582** (SGAE-2157) PRODUCTION OF A CLEAN NEUTRON GAS FOR DECAY AND SCATTERING EXPERIMENTS. Dobrozemsky, R. (Oesterreichische Studiengesellschaft fuer Atomenergie G. m. b. H., Seibersdorf. Physik-Inst.). Aug 1973. 109p. Dep. NTIS (U. S. Sales Only) $7.50.

It is shown that the neutron densities required for a number of basic experiments with free neutrons can, at present, only be achieved with the thermal neutron gas produced by a fission reactor. Three basic technological problems in the production of a dense and clean neutron gas were investigated experimentally: (a) measurement of the neutron field in the neutron gas cavity (flux- and current-densities, anisotropy), (b) attainment of a low residual gas density in the neutron gas cavity in the presence of strong radiation fields, and (c) shielding of the measuring device from the primary reactor radiation. In our experiments we use a dense neutron gas in ultra-high vacuum to determine the electron-neutrino angular correlation coefficient a by a precision measurement of the recoil-proton energy spectrum in free-neutron decay (O to 751 eV). A neutron density of 1.42 × $10^7$ neutrons/cm$^3$ was achieved in a cavity with residual gas density of 3.5 × $10^9$ molecules/cm$^3$ giving a flux of 88 protons/sec into the energy spectrometer. Aside from the technological problems mentioned, low magnetic and electric fields in the beam tube are necessary as well; disturbing fields of less than 1 mV/cm and 1 mOe were achieved. Preliminary results are discussed. Based on the experience obtained from these experimental studies we discuss proposals for n-n scattering and for scattering of charged particles from a neutron gas target. The feasibility of n-n experiments with existing reactors, as well as the installation of neutron targets in storage rings is discussed. In connection with a 20 A proton beam n-p scattering with luminosity up to $10^{31}$ can be performed by means of neutron targets produced from a medium-size research reactor. (auth)

**1583** ITERATIVE SYNTHESIS OF NEUTRON TRANSPORT EQUATIONS SOLUTIONS. Khromov, V. V.; Sirotkin, A. M.; Apse, V. A. At. Energ. (USSR); 35: No. 2, 89-93(Aug 1973). (In Russian).

Iterative methods for the synthesis of neutron transport equation solutions in multidimensional problems are discussed. These methods are based on the assumption that the calculated function describing neutron space-energy distribution in a nuclear reactor may be represented by a sum of functions with separated variables. Algorithms of methods of synthesis in sets of continuous and discontinuous functions are presented. A number of examples illustrate methods of obtaining iterative synthesis equations. Calculations indicate that it is possible to achieve results of high accuracy by means of iterative synthesis. A brief description of program, RADAR, a program for two-dimensional reactor calculation in the multigroup diffusion approximation, is presented. (auth)

**1584** GENERALIZED NELKIN'S EXPANSION IN PLANE LATTICES BY PERTURBATION CALCULUS. Van Binnebeek, J. J. (Univ., Brussels). J. Nucl. Energy; 27: No. 9, 607-617 (Sep 1973).

The decay of a neutron burst in a plane lattice with symmetric cells is computed by perturbation calculus up to the second order. The perturbation is shown to be negative when the unperturbed system is the homogeneous system obtained by volume averaging of the cross-section in the cell. As an illustration, generalized Nelkin's expansion is computed for plane water-beryllium lattices. (auth)

**1585** RADIAL DIFFUSION COEFFICIENT IN A CYLINDRICAL CELL BY $P_3$ METHOD. Takeda, T.; Azekura, K.; Sekiya, T. (Osaka City Univ.). J. Nucl. Energy; 27: No. 9, 619-631(Sep 1973).

The radial diffusion coefficient for a cylindrical cell is calculated by the $P_3$-approximation in one-group theory. Williams calculated the anisotropic diffusion coefficient in a cylindrical cell by the $P_3$-approximation: the calculation was, however, limited to the axial diffusion coefficient. Therefore the radial diffusion coefficient is calculated by using the cylindrical approximation introduced by Williams and by following the concise procedure of the $P_N$-method by Davison. As an example of numerical calculation a cell is treated consisting of two different regions, a fuel rod and a surrounding moderator. Results from the present method are compared with those from the diffusion theory and from the collision probability method. (auth)

**1586** COMPARISON BETWEEN BENOIST AND SELENGUT DIFFUSION COEFFICIENTS IN ONE-VELOCITY THEORY WHEN ABSORBING MEDIA ARE PRESENT IN THE CELL. Berna, P. (CEN de Cadarache, Saint-Paul-les-Durance, France). J. Nucl. Energy; 27: No. 9, 633-643(Sep 1973).

Using heterogeneous formalism the Selengut equivalent diffusion coefficient and absorption cross-section for a heterogeneous cell containing absorbing media are calculated. The observed deviations between Benoist and Selengut diffusion coefficients and also between average and Selengut absorption cross-sections are almost exactly compensated by cell-edge flux normalization in the thermal group. (auth)

## Nuclear Properties and Reactions, A ≤ 5

*Refer also to abstracts 1409, 1411, 1486, and 1763.*

**1587** (KFK-EXT-3/73-1) ELASTIC SCATTERING $^3$He($^4$He, $^4$He)$^3$He AT MEDIUM ENERGIES. Fetscher, W. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Reaktorphysik). May 1973. 69p. (In German). Dep. NTIS (U. S. Sales Only) $5.50.

Thesis. Submitted to Karlsruhe Univ. (West Germany).

The elastic scattering $^3$He($^4$He, $^4$He)$^3$He has been studied at the five energies $E_{CM}$ = 28.0, 32.0, 37.0, 40.5, and 44.0 MeV in the center of mass system by scattering 104 MeV $\alpha$-particles on a $^3$He gas target. The differential cross section has been measured at all five energies in the angular range from 20° to 160°. Additionally a double scattering experiment according to the Rosen-Brolley method has been performed, in which in one measurement of the asymmetry the absolute value of the polarization P of the scattered $^3$He-particle can be determined. The measured right-left asymmetry is $A = P^2$. At the center of mass angle $\theta_{CM} = 132°$ and the energy $E_{CM}$ = 42 MeV the value $A = -0.007 \pm 0.047$ was found. This yields an upper limit for the polarization: $|P(132°, 42\ \text{MeV})| \leqq 0.22$. Apparative asymmetries have been measured in a simultaneous null-experiment with $\alpha$-particles. These asymmetries were found to be less than 0.02. (LBS)

**1588** (KFTI-72-22) INVESTIGATION POSSIBILITY OF $^4$He($\gamma,\pi^0$)$^4$He REACTION BY MEANS OF DIFFUSION CHAMBER BY DIFFERENTIAL METHOD. Arkatov, Yu. M.; Vatset, P. I.; Voloshchuk, V. I.; Kirichenko, V. V.; Khodyachikh, A. F. (Akademiya nauk Ukrainskoi SSR, Kharkov. Fiziko Tekhnicheskii Institut). 1972. 16p. (In Russian). INIS.

The possibility of investigating the reaction of the elastic photoproduction of $\pi^0$ mesons on $^4$He with the diffusion chamber by the differential method was examined. Preliminary data were reported. (8 figures) (tr-auth)

**1589** COMPARISON OF $\pi^+$ AND $\pi^-$ TOTAL CROSS SECTIONS OF LIGHT NUCLEI NEAR THE 3 TO 3 RESONANCE. Wilkin, C.; Cox, C. R.; Domingo, J. J.; Gabathuler, K.; Pedroni, E.; Rohlin, J.; Schwaller, P.; Tanner, N. W. (CERN, Geneva). Nucl. Phys.; B62: 61-85(1973).

The total cross sections of $^4$He, $^6$Li, $^7$Li, $^9$Be, $^{12}$C and $^{32}$S for positive and negative pions were measured in the energy range 80 to 260 MeV in a transmission experiment. Coulomb corrections were applied using real parts of the forward nuclear amplitudes as determined from dispersion relations. At the lower energies there remain large residual differences between the $\pi^+$ and $\pi^-$ scattering on the isoscalar nuclei. These can be largely understood in terms of the Coulomb distortion. (auth)

**1590** (p,2p) REACTION OF $^2$H, $^3$He, AND $^4$He. Pugh, H. G.; Roos, P. G.; Cowley, A. A.; Cheng, V. K. C.; Woody, R. (Univ. of Maryland, College Park). Phys. Lett.; 46B: No. 2, 192-194 (17 Sep 1973).

The (p,2p) cross sections on $^2$H, $^3$He and $^4$He were measured at 65, 85 and 100 MeV. The experimental data show rather strong energy and target mass dependence, particularly for $^4$He. (auth)

**1591** TEST OF ISOSPIN CONSERVATION BY A COMPARISON OF THE REACTIONS $^3$H($^3$He,$^4$He)$^2$H AND $^3$He($^3$He,$^4$He)2p. Roberts, W. J. Knoxville, TN; Univ. of Tennessee (1973). 79p. University Microfilms Order No. 73-20,030.

Thesis (Ph. D.).

The absolute differential cross sections for the reactions A) $^3$H($^3$He,$^4$He)$^2$H and B) $^3$He($^3$He,$^4$He)2p were measured at 16.0 MeV cm, using final-state-interaction theory, the cross section for leaving the diproton in the $^1S_0$ state was extracted for reaction B. Conservation of isospin requires this cross section to have twice the magnitude and the same angular distribution as reaction A. Isospin conservation also requires that reaction A be symmetric about 90° cm. At 16.0 MeV cm deviations from 90° symmetry were found for reaction A which are consistent with lower energy data. In addition, deviations from isospin conservation are reported for the comparison test. By using a single-nucleon-transfer model both the deviation from symmetry for reaction A and the deviations from the factor of two for comparing reactions A and B can be qualitatively explained. (Diss. Abstr. Int., B)

**1592** EXCITED STATES OF LIGHT HYPERNUCLEI. CERN-Heidelberg-Warsaw Collaboration. Nucl. Phys.; B60: No. 1, 1-25 (1973).

The $\gamma$ spectra obtained with $K^-$ mesons stopped in $^6$Li and $^7$Li targets exhibited a $\gamma$ line at 1.09 MeV (intensities 0.14 ± 0.02% and 0.37 ± 0.04%, respectively) which could be identified as a hypernuclear line, and a second one at 1.42 MeV (intensities 0.10 ± 0.02% and 0.04 ± 0.04%, respectively), the assignment of which is less certain. The 1.09 MeV line and the 1.42 MeV line (if this latter is, in fact, a hypernuclear one) must both be due to $\gamma$ transitions in hypernuclei with mass number four. The excitation energy of 1.09 MeV, ascribed in turn to either ${}^4_\Lambda H^*$ or ${}^4_\Lambda He^*$, was used to recalculate the parameters of the phenomenological potentials proposed by Herndon and Tang for the $\Lambda$-N s-state interaction. (auth)

**1593** ABSORPTION OF PIONS IN $^3$He. Phillips, A. C.; Roig, F. (Univ. of Manchester, Eng.). Nucl. Phys.; B60: No. 1, 93-109(1973).

The two-nucleon absorption model is submitted to a quantitative test by considering pion absorption in $^3$He. The wave functions of $^3$He are explicitly constructed in terms of wave functions for the S-wave two-nucleon systems. Several prescriptions for the range dependence of the pion absorption interaction are considered, the effective coupling constants of which are determined from the data on pion production in nucleon-nucleon collisions. It is shown that the usual assumption of no short-range repulsion and of a zero-range absorption interaction is too naive to give reliable results. When the effects of the nuclear short-range repulsion and the finite range of the pion absorption interaction are included, the model gives a ratio for the nnp and nd production rates which agrees with experiment. The theoretical absorption rates for S-wave pions are $W^S(\text{nd}) = (0.9 \pm 0.4) \cdot 10^{16}\ \text{sec}^{-1}$, $W^S(\text{nnp}) = (3.2 \pm 0.8) \cdot 10^{16}\ \text{sec}^{-1}$. These results agree with experiment if a radiative absorption rate of $4.43 \cdot 10^{15}\ \text{sec}^{-1}$ is assumed and if the ratio for absorption from a 2p and from a 1s state is $0.65 \cdot 10^{-4}$. This agreement indicates that the basic idea of two-nucleon absorption could be correct. (auth)

**1594** ELASTIC SCATTERING OF VECTOR POLARIZED DEUTERONS BY $^4$He. Chang, C. C.; Glavish, H. F.; Avida, R.; Boyd, R. N. (Stanford Univ., CA). Nucl. Phys.; A212: No. 1, 189-196(1973).

The vector analyzing power $iT_{11}$ for deuterons elastically scattered by $^4$He has been measured for cm angles between 51.8° and 158.9° and deuteron energies in the range 11.5 to 17 MeV. The results show d–$\alpha$ scattering is a convenient analyzer for deuteron vector polarization in the energy range investigated, since the angular dependence of $iT_{11}$ is fairly insensitive to energy and the magnitude of $iT_{11}$ is quite large at some angles. (2 figures, 1 table) (auth)

**1595** TWO-BODY PHOTODISINTEGRATION OF THE $^3$He NUCLEUS. Hendry, J. A. (Univ. of Liverpool); Phillips, A. C. Nucl. Phys.; A211: No. 3, 533-540(1973).

The two-body photodisintegration of $^3$He is calculated using $^3$He and proton-deuteron wave functions obtained by assuming a separable interaction for the two-nucleon t-matrix. It is shown that the isotropic component of the cross section is unlikely to yield useful information on the D-state probability densities of the deuteron and $^3$He. A detailed comparison is made with the data on the cross section at 90°. The separable approximation can account for some of the experimental results, but other experiments suggest that a more sophisticated treatment of the nuclear interactions and wave functions is necessary. (auth)

**1596** THREE-NUCLEON EXPERIMENTS AND $^2$S DEFECTS. Saylor, D.P.; Rad, F.N. (Cyclotron Institute, Texas A&M University, College Station, Texas 77843). Phys. Rev. C 8: No. 2, 507-510 (Aug 1973).

Supported by the results of recent theoretical calculations of nucleon-deuteron scattering, it is suggested that most parts of the calculated three-nucleon scattering and breakup amplitudes are model–independent at low energies and, furthermore, that the $^{2}$S–state amplitudes are the important exception to this rule. On the basis of the assumption that it is only differences between theoretical and physical $^{2}$S amplitudes which will remain substantial as calculations improve, a new approach to the experimental three–nucleon problem is proposed. According to this approach, experiments would be chosen on the basis of the sensitivity to $^{2}$S amplitudes and would be analyzed by using theoretical predictions for the amplitudes and empirically adjusted $^{2}$S defects. Experiments expected to be sensitive to the $^{2}$S amplitudes are discussed including angular distributions, spin–correlation measurement, and experiments of the triple–scattering type. Formulas for these parameters are given in terms of amplitudes having the simple structure predicted by the Amado model and it is shown how the $^{2}$S defects will modify such predictions. (auth)

**1597** MECHANISMS IN $^{3}$H + $^{3}$He AND $^{3}$H + $^{2}$H REACTIONS. Slaus, I. (Institute R. Bošković, Zagreb, Yugoslavia); Allas, R.G.; Beach, L.A.; Bondelid, R.O.; Petersen, E.L.; Lambert, J.M.; Shannon, D.L. Phys. Rev. C 8: No. 2, 444-455 (Aug 1973).

The study of $^{3}$H + $^{3}$He reactions at $E_{3He}=50$ MeV, $^{3}$H + $^{2}$H reactions at $E_{d} = 35$ MeV, as well as the reanalysis of $^{2}$H($^{3}$He, pt)p reaction demonstrates that the quasifree reaction mechanism plays an important role. Evidence for the quasifree reaction mechanism is found in the processes $^{3}$H($^{3}$He, dd)d, $^{3}$H($^{3}$He, pt)d, $^{3}$H($^{3}$He, dt)p, $^{3}$H($^{3}$He, pα)n, $^{2}$H($^{3}$He, pt)p, and $^{3}$H($^{2}$H, pt)n. Evidence for d–d, p–$^{3}$He, d–$^{3}$He, and p–t quasifree scattering is found in the processes $^{3}$H($^{2}$H, dd)n, $^{3}$H($^{3}$He, p$^{3}$He)2n, $^{3}$H($^{3}$He, d$^{3}$He)n, and $^{3}$H($^{2}$H, pt)n, respectively. Comparing the absolute cross sections of these reactions, one concludes that though the shapes of the correlation spectra indicate the significance of quasifree reaction mechanisms, the pole diagram is not dominant. (auth)

**1598** $^{4}$He(γ,p)t REACTION FOR PHOTON ENERGIES BETWEEN 180 AND 320 MeV. Kiergan, S.E.; Hanson, A. O.; Koester, L.J. Jr. (Physics Department, University of Illinois, Urbana, Illinois 61801). Phys. Rev. C 8: No. 2, 431-439 (Aug 1973).

The differential cross section for the reaction $^{4}$He(γ, p)t was measured in a spark chamber experiment for photon energies between 180 and 320 MeV and proton c.m. angles between 60 and 120°. The results show that the cross section continues to decline with increasing energy. No evidence of a peak was found in the region of the first pion–nucleon resonance. An empirical function, involving the nucleon momentum distribution in the nucleus, was derived from a simple model of the photodisintegration process, and was used to correlate the observed differential cross sections over a large range of energy and angle. (auth)

**1599** PRECISE SINGLE–SCATTERING OPTICAL–POTENTIAL FIT TO 1–GeV p–$^{4}$He ELASTIC SCATTERING. Saperstein, A. M. (Department of Physics, Wayne State University, Detroit, Michigan, 48202). Phys. Rev. Lett. 30: No. 25, 1257-1259 (18 June 1973).

Using a relativistic form for the relation between the nucleon–nucleon scattering amplitude and the scattering operator, a single–scattering nucleon–nucleus optical potential is found which gives a precise fit with no adjustable parameters to the small–angle scattering of protons on $^{4}$He at 1–GeV incident lab energy. The method then allows a determination of the ratio of real to imaginary nucleon–nucleon foward–scattering amplitudes at other energies such as 600 MeV. (auth)

## Nuclear Properties and Reactions, $6 \leq A \leq 19$

*Refer also to abstracts 1371, 1379, 1486, 1589, 1626, 1627, 1650, 1735, 1737, 1758, and 1765.*

**1600** (FRNC-TH–394) MECHANISM OF TRANSFER REACTIONS BETWEEN HEAVY IONS INVOLVING SEVERAL NUCLEONS. Roynette, J. C. (Paris Univ., Orsay (France)). 1973. 87p. (In French). Dep. NTIS (U. S. Sales Only) $6.50.

Thesis.

Many-nucleon transfer reactions involving k nucleons and the formation of the same residual $^{16}$O nucleus were studied: $^{12}$C($^{16}$O, $^{12}$C), $^{12}$C($^{20}$Ne, $^{16}$O), $^{12}$C($^{14}$N, $^{10}$B), $^{13}$C($^{16}$O, $^{13}$C), $^{13}$C($^{12}$C, $^{9}$Be), and $^{11}$B($^{12}$C, $^{7}$Li). Incident energies two or three times higher than the Coulomb barrier were considered. In addition, the $^{13}$C($^{16}$O, $^{12}$C), $^{12}$C($^{16}$O, $^{13}$C), and $^{12}$C($^{14}$N, $^{11}$B) reactions leading to the adjacent $^{17}$O and $^{15}$O nuclei were studied. In this way, transfer reactions involving 4 or 3 nucleons were compared, together with the same reaction on two neighboring targets, and information on the reaction mechanisms and the spectroscopy of the levels reached was obtained. An attempt is made to explain the angular distributions in the framework of the distorted-wave calculation, taking into account recoil effects. This calculation is applied to single-nucleon transfer, and it is shown that the result is similar to that obtained by Liu. This same formalism is used to study the angular distributions corresponding to the transfer of 4 nucleons, treating the 4 transferred nucleons as an α particle. (FR)

**1601** (IAE-2222) TOTAL NEUTRON CROSS SECTION FOR BERYLLIUM. Gerasimov, V. F.; Zenkevich, V. S.; Moskalev, S. S.; Markov, D. A.; Kheruvimov, A. V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1972. 11p. (In Russian). Dep. NTIS (U.S. Sales Only) $3.00.

The measurement of the total cross sections of samples of beryllium with different textures in the energy region from 0.005 to 10 eV is reported. The measurement was performed on the neutron time-of-flight spectrometer at the IAE electron accelerator. A strong dependence of the total cross section on the Be texture was found. Average values of $\langle\sigma_t\rangle$ and $\langle 1/\sigma_t\rangle$ were calculated for a Maxwell spectrum with different effective temperatures. (7 figures, 1 table) (tr-auth)

**1602** (INR–1461) OPTICAL MODEL AND HAUSER–FESHBACH ANALYSIS OF $^{9}$Be + d and $^{10}$B + p INTERACTIONS AT LOW ENERGIES. Zwieglinski, B.; Piotrowski, J.; Saganek, A.; Sledzinska, I. (Institute of Nuclear Research, Warsaw (Poland)). 1973. 32p. Dep. NTIS (U. S. Sales Only) $3.75.

The available data for the elastic scattering of deuterons from $^{9}$Be in the energy range from 1.1 to 2.5 MeV are analyzed in terms of the optical model, as an introduction to a DWBA study of the $^{9}$Be(d,p)$^{10}$Be reaction. It was confirmed that the energy dependence of the parameters of the imaginary part of the deuteron potential is similar to that observed for other light nuclei. The angular distributions from the elastic scattering of protons by $^{10}$B in the energy range from 5.5 to 12.2 MeV were found to be satisfactorily described by the combined optical model and Hauser – Feshbach theories. Satisfactory agreement has been obtained between the calculated and experimental $^{10}$B(p,α) $^{7}$Be, $^{10}$B(p,p') $^{10}$B and $^{10}$B(p,n) $^{10}$C total cross sections. This seems to indicate that compound nucleus formation is the mechanism dominating in these reactions. (9 figures, 2 tables) (auth)

**1603** CURRENT ALGEBRA DETERMINATION OF K$^{-}$-NUCLEAR SCATTERING LENGTHS. Hakim, S. J. (International Centre for Theoretical Physics, Trieste, Italy). Nucl. Phys.; B61: 116-124(1973).

Use is made of the Fubini-Furlan current algebra sum rules to calculate the real part of the K$^{-}$-nuclear ($A \lesssim 24$) scattering lengths a. Re a is expressed in terms of equal-time commutators of currents and a dispersive integral over the off-mass-shell scattering amplitude. In evaluating the dispersion integral it is assumed that kaon capture occurs predominantly on a single nucleon. The kaon nucleus sigma term is written as a coherent sum of kaon nucleon sigma terms $\sigma_{KN}$. Due to inconsistencies in the determinations of $\sigma_{KN}$ the results for different values of $\sigma_{KN}$ are presented. (auth)

**1604** NON-NORMAL PARITY STATES IN A = 16 AND 15 NUCLEI. Wang, M. C.; Lee, T. Y.; Hsieh, S. T.; Chiang, H. C. (National Tsing Hua Univ., Hsinchu, Taiwan). Ching. J. Phys. (Taiwan); 11: No. 1, 65-76(Apr 1973).

The low-lying non-normal parity states of A = 16 and 15 nuclei are studied in the conventional shell model. Part of the $3\hbar\omega$ excitations is considered and the two-body interactions between a 1p and a 2s, 1d nucleon are determined by a least-squares fit calculation with phenomenological potentials. The resultant energy spectra agree with experimental data quite well. The giant electric dipole resonance in $^{16}$O is discussed. (auth)

**1605** INTERFERENCE OF TWO-NEUTRON AND α-TRANSFER IN THE REACTION $^{14}$C($^{16}$O,$^{18}$O)$^{12}$C. Schneider, W. F. W.; Kohlmeyer, B.; Puehlhofer, F.; Bock, R. (Univ., Marburg, Ger.). Phys. Lett.; 46B: No. 2, 195-197(17 Sep 1973).

Angular distributions of the reaction $^{14}$C($^{16}$O,$^{18}$O)$^{12}$C were measured at E($^{16}$O) = 20, 25 and 30 MeV. Strong oscillations at energies close to the Coulomb barrier are explained by assuming interference between two-neutron and α-particle transfer. Results of a DWBA analysis using the fixed-range approximation are presented. (auth)

**1606** PROTON SPECTRA FROM THE $^{6,7}$Li(γ,p)$^{5,6}$He REACTIONS AT $E_{\gamma} = 60$ MeV. Gardiner, S. N.; Matthews, J. L.; Owens, R. O. (Univ. of Glasgow). Phys. Lett.; 46B: No. 2, 186-188(17 Sep 1973).

The $^{6,7}$Li(γ,p) reactions were investigated for $E_{\gamma} = 60$ MeV. Excitation of residual $(1p)^{-1}$ and $(1s)^{-1}$ hole states is evident from the proton spectra measured at $\Theta_p = 45°$. The data are compared with a theoretical calculation which includes short-range correlations. (auth)

**1607** MULTICHANNEL THREE-α MODEL OF $^{12}$C. Han, C. S.; Chuu, D. S.; Lin, D. L. (State Univ. of New York, Buffalo). Nucl. Phys., A212: No. 2, 241-252(1973).

A multichannel three-$\alpha$ model is constructed to calculate the ground and first excited state energies of $^{12}$C by assuming that the internal structure of the $\alpha$-particle is approximately represented by a two-level system. The multichannel $\alpha$-$\alpha$ potential is obtained by fitting the low energy scattering data near the resonances. The Faddeev equations are generalized to allow the internal structure of the particles, and are solved in the separable t-matrix approximations for bound state energies. The results obtained are in good agreement with experiments and the effect of the $\alpha$ internal structure is discussed. (auth)

**1608** PHASE-SHIFT AND OPTICAL-MODEL ANALYSIS OF THE ELASTIC SCATTERING OF NEUTRONS FROM $^{12}$C. Abbondanno, U. (Univ., Trieste, Italy); Demanins, F.; Lagonegro, M.; Nardelli, G. Lett. Nuovo Cim.; 8: No. 4, 259-265(22 Sep 1973).

A measurement of the angular distribution of neutrons elastically scattered from carbon-12 at 1.98 to 4.64 MeV, where the elastic scattering is the only energetically allowed reaction channel for the outgoing neutrons, is presented. Differential cross sections and resonances are also found. The purpose is to improve the experimental data and to present a phase shift and an optical model analysis of the results. (JFP)

**1609** CLUSTER-TRANSFER ANALYSIS OF THE $^{7}$Li($^{3}$He,p)$^{9}$Be REACTION. Werby, M. F.; Edwards, S. (Florida State Univ., Tallahassee). Nucl. Phys.; A213: No. 2, 294-308(1973).

An exact finite-range two-mode multi-interaction DWBA cluster-transfer analysis of the $^{7}$Li($^{3}$He,p)$^{9}$Be reaction for $^{3}$He bombarding energies of 3.2, 4.5, and 10 MeV is performed using the computer code FANLU2. It is found that it is essential to include the exchange mode in order to describe the angular distributions at backward angles and that the analysis provides a good overall description of the reaction when the full exact finite-range multi-interaction formalism is employed. Extracted spectroscopic factors indicate that d $\oplus$ $^{7}$Li is a more probable cluster configuration for $^{9}$Be than is $^{3}$He $\oplus$ $^{6}$He, but the latter configuration plays an important role in the analysis. The various cancellation approximations that can be employed in the DWBA are shown to be inadequate for this reaction. (auth)

**1610** GAMMA DECAY IN $^{19}$Ne. Davidson, J. M. (Univ. of Maryland, College Park); Roush, M. L. Nucl. Phys.; A213: No. 2, 332-340(1973).

The reaction $^{17}$O($^{3}$He,n$\gamma$)$^{19}$Ne was studied at incident energies of 3.0, 4.0 and 5.0 MeV. Fourteen previously unreported transitions in $^{19}$Ne were identified in n-$\gamma$ coincidence spectra. Limits on lifetimes for seven levels were determined using the Doppler-shift attenuation method. The analogs in $^{19}$Ne states are identified on the basis of $\gamma$-ray branchings. It is suggested that the previous report of a state at 4.78 MeV in $^{19}$Ne is erroneous and that the state at 4.68 MeV in $^{19}$F is the analog of the 4.71 MeV state in $^{19}$Ne. (auth)

**1611** CHARGE ASYMMETRY IN THE MASS-13 ISOBAR. Sato, H.; Yoshida, S. (Rutgers—The State Univ., New Brunswick, NJ). Nucl. Phys.; A211: No. 3, 509-532(1973).

Taking into account the Coulomb interaction as a perturbation to the charge-independent forces, the charge-asymmetric properties of the lowest $T = \frac{3}{2}$, $I = \frac{3}{2}$ and the ground $T = \frac{1}{2}$, $I = \frac{1}{2}$ states for the mass-13 nuclei are investigated. The charge-independent wave function by Cohen and Kurath is used as a basis, and the radial wave function is generated to fit the charge radius obtained by the electron scattering experiments. The effect of the Coulomb interaction is taken into account in a first-order perturbation calculation. The Coulomb energies are calculated, and the isobaric multiplet mass equation is obtained. Overall agreement with experimental data is obtained for the $T = \frac{3}{2}$ and $I = \frac{3}{2}$ state, although it is found difficult to fit accurately for the ground state. The isospin-forbidden nucleon widths are also calculated using the wave function obtained above and taking into account the neglected terms. The results are not essentially different from the previous ones. The M1 transition and $\beta$-decay rate between the $T = \frac{3}{2}$, $I = \frac{3}{2}$ and the $T = \frac{1}{2}$, $I = \frac{1}{2}$ states are also calculated, and a small charge asymmetry is obtained which is not enough to explain experimental data. (3 figures, 14 tables) (auth)

**1612** ANGULAR CORRELATION MEASUREMENTS IN THE $^{7}$Li(d,n$\alpha$)$^{4}$He REACTION. Heggie, J. C. P.; Martin, P. W. (Univ. of British Columbia, Vancouver). Nucl. Phys.; A212: No. 1, 78-92(1973).

A kinematically complete experiment has been performed in which alpha-neutron angular correlation measurements were recorded at an incident deuteron energy of 1.0 MeV. As in previous experiments, the results show that the yield is dominated by sequential decay through the $^{5}$He ground state and the $^{8}$Be first excited state. An observed asymmetry of the $^{5}$He decay products about the system center-of-mass recoil direction can be explained on the basis of compound nucleus formation. In particular, the results suggest a possible spin and parity assignment of $\frac{3}{2}^{+}$ for the level at 17.48 MeV excitation in the $^{9}$Be compound nucleus. (13 figures, 2 tables) (auth)

**1613** 6.05 MeV $0^{+}$ STATE IN $^{16}$O: A SHAPE ISOMER. Soerensen, B. (Univ. of Copenhagen). Nucl. Phys.; A211: No. 3, 565-572(1973).

A variational calculation predicts the existence of a quadrupole deformed isomeric state in $^{16}$O, which may be associated with the observed rotational band starting at 6.05 MeV. Calculated B(E2) value and strength in the $^{18}$O(p,t) reaction support this interpretation. (2 figures, 2 tables) (auth)

**1614** ELASTIC AND INELASTIC SCATTERING OF $^{12}$C BY $^{12}$C IN THE ENERGY RANGE BETWEEN 10 AND 37.6 MeV. Emling, H.; Nowotny, R.; Pelte, D.; Schrieder, G. (Univ., Heidelberg). Nucl. Phys.; A211: No. 3, 600-616(1973).

The elastic and inelastic scattering of $^{12}$C by $^{12}$C has been measured over a wide angular range by employing a kinematical analysis with the help of position-sensitive detectors. The bombarding energy was varied in 200 keV steps between 10 and 37.6 MeV. The cross sections are analyzed in the framework of compound fluctuations and the direct reaction model. (5 figures, 1 table) (auth)

**1615** SINGLE-CHARGE EXCHANGE ($\pi^{+}$, $\pi^{0}$) IN LIGHT NUCLEI. Cheon, I. (Institut de Physique, Université de Liège, Sart-Tilman, B-4000 Liège 1, Belgium). Phys. Rev. C 8: No. 2, 534-540 (Aug 1973).

The total and differential cross sections were calculated for $^{13}$C($\pi^{+}$, $\pi^{0}$)$^{13}$N, considering the effects of double and triple scatterings as well as pion absorption. An attempt is also made to explain the extremely small total cross section for $^{14}$N($\pi^{+}$, $\pi^{0}$)$^{14}$O compared with other cases $^{10}$B, $^{11}$B, $^{13}$C, and $^{18}$O. (auth)

**1616** NOTE ON THE PARITIES OF THE 7.97- TO 8.197-MeV STATES IN $^{17}$O AND THE $^{13}$C($\alpha$, n) $^{16}$O REACTION AS A SOURCE OF POLARIZED NEUTRONS. Busch, C.E.; Donoghue, T.R.; Keane, J.A.; Schieck, H.P.g.; Seyler, R.G. (Department of Physics, The Ohio State University, Columbus, Ohio 43210). Phys. Rev. C 8: No. 2, 848-850 (Aug 1973).

We have measured the angular distributions of the neutron polarization for the $^{13}$C($\alpha$, n) reaction at $E_{\alpha}$ = 2.075, 2.225, and 2.43 MeV to determine $J^{\pi}$ assignments for states in $^{17}$O at 7.97, 8.07, and 8.197 MeV. Our analysis of $\sigma$ ($\theta$) and P($\theta$) data shows that the parity assignments reported by Schölermann for these states are ambiguous due to the spin and parity structure of the $^{13}$C($\alpha$, n)$^{16}$O reaction. The usefulness of this reaction as a source of polarized neutrons is also discussed briefly. (auth)

**1617** ACCELERATOR PRODUCTION OF $^{8}$B NEUTRINOS. Marrs, R.E.; Bodansky, D.; Adelberger, E.G. (Department of Physics, University of Washington, Seattle, Washington 98195). Phys. Rev. C 8: No. 2, 427-430 (Aug 1973).

The $^{8}$B yield from the reaction $^{6}$Li($^{3}$He, n)$^{8}$B has been measured from 8.9 to 26.5 MeV (lab) by counting the annihilation $\gamma$ rays from the 0.762-sec positron decay of $^{8}$B. The measurement was motivated by the negative results of the Davis solar neutrino experiment, and the consequent possible usefulness of direct tests of neutrino detection systems with neutrinos from the decay of $^{8}$B. The present upper limit on the capture of solar neutrinos in $^{37}$Cl is 1 SNU, corresponding to a flux of $0.74 \times 10^{6}$ $^{8}$B neutrinos per cm$^{2}$ sec. It was found that a $^{3}$He$^{+}$ current of 30 mA at 24 MeV is required to produce this $^{8}$B neutrino flux at a distance of 8 m from the target, indicating that the contemplated test is not impossible. (auth)

**1618** EXPERIMENTAL EVIDENCE FOR REPULSIVE CORES IN HEAVY-ION REACTIONS. Michaud, G. (Département de Physique, Université de Montréal,. Montréal, Québec, Canada). Phys. Rev. C 8: No. 2, 525-533 (Aug 1973).

The simultaneous study of the $^{12}$C + $^{12}$C, $^{12}$C + $^{16}$O, and $^{16}$O + + $^{16}$O total reaction cross sections at low energy strongly suggests that the optical potential of the heavy ions has a central soft repulsive core. Conventional Woods-Saxon potentials can fit the $^{12}$C + $^{12}$C and $^{16}$O + + $^{16}$O reactions on the one hand or the $^{12}$C + $^{16}$O reactions on the other but only the potentials with the repulsive core can fit all three reactions with the parameters varying smoothly from reaction to reaction. These reactions also determine accurately the surface thickness of the imaginary part of the potential; it varies from 0.35 fm for the $^{16}$O + + $^{16}$O reaction to 0.55 fm for the $^{12}$C + $^{12}$C reaction. At very low energies most of the absorption takes place while the two nuclei are far from each other. (auth)

**1619** $^{15}$C STATES VIA THE $^{14}$C(d, p)$^{15}$C REACTIONS. Goss, J.D.; Rollefson, A.A.; Browne, C.P. (Department of Physics, University of Notre Dame, Notre Dame, Indiana 46556); Blue, R.A.; Weller, H.R. Phys. Rev. C 8: No. 2, 514-517 (Aug 1973).

Protons from the ${}^{14}$C(d, p)${}^{15}$C reaction were analyzed with a magnetic spectrograph. Data were taken at the bombarding energies of 12.0, 13.0, and 14.0 MeV at the observation angles of 60, 90, and 120 °. Nine states were found in ${}^{15}$C between the ground state and the 7.35–MeV region of excitation. Excitation energies and uncertainties in keV are 744.1 ± 2, 3105.3 ± 5, 4221.1 ± 3, 6428.1 ± 7, 6539.8 ± 5, 6844.9 ± 5, 6882.4 ± 5, 7097.2 ± 6, and 7351.3 ± 6. Widths of approximately 42 and 61 keV were measured for the levels at 3105.3 and 6428.1 keV, respectively. Uncertainties in excitation energies are reduced by almost an order of magnitude from previous work. (auth)

**1620** PRODUCTION OF THE LIGHT ELEMENTS LITHIUM, BERYLLIUM, AND BORON BY PROTON–INDUCED SPALLATION OF ${}^{14}$N. Laumer, H.; Austin, S.M.; Panggabean, L.M.; Davids, C.N. (Cyclotron Laboratory, Physics Department, Michigan State University, East Lansing, Michigan 48823). Phys. Rev. C 8: No. 2, 483-491 (Aug 1973).

Astrophysically interesting cross sections for the production of isotopes of lithium, beryllium, and boron in the proton–induced spallation of ${}^{14}$N were measured for proton energies between 17 and 42 MeV. A time–of–flight method was used for mass identification, supplemented at one energy by radioactivity analysis. Gas targets were used throughout. The astrophysical significance of the results is discussed. (auth)

**1621** LEVEL STRUCTURE OF ${}^{17}$O FROM NEUTRON TOTAL CROSS SECTIONS. Fowler, J.L.; Johnson, C.H.; Feezel, R.M. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). Phys. Rev. C 8: No. 2, 545-562 (Aug 1973).

The neutron total cross section of oxygen is measured in the energy regions from 0.6 to 0.9, 1.12 to 1.16, and 1.39 to 4.33 MeV. More than half of this region is surveyed with energy resolution and energy steps of about 2.5 keV. On the basis of these data and supplementary published data on the (n, n) angular distributions and the ${}^{13}$C($\alpha$, n) reaction, the ${}^{17}$O level energies in MeV and, in brackets, $J^\pi$ values and center–of–mass total widths, $\Gamma_T = \Gamma_n + \Gamma_\alpha$ in keV, are: 5.696 [$(7/2)^-$, 3.4]; 5.731 [not $(1/2)^+$, < 1.0]; 5.867 [$(3/2)^+$, 6.6]; 5.937 [$(1/2)^-$, 32]; 6.354 [$(1/2)^+$, 124]; 6.860 [not $(1/2)^+$, < 1.0]; 6.970 [not $(1/2)^+$, < 1.0]; 7.163 [$(5/2)^-$, 1.4]; 7.20 [$(3/2)^+$, 280]; 7.377 [$(5.2)^+$, 0.5]; 7.380 [$(7/2)^-$, 1.2]; 7.56 [$(3/2^-$, 500]; 7.685 [$(7/2)^-$, 18]; 7.955 [$(1/2)^+$, 90] 7.99 [$(1/2)^-$,260]; 8.058[$(3/2)^+$,86]; 8.18[$(1/2)^-$,69]; and 8.20 [$(3/2)^-$,52]. Resonances are not observed for known ${}^{17}$O levels at 5.215 and 7.573 MeV; these levels have $\Gamma_T < 0.1$ keV. The previously reported narrow 3/2+ level at 7.694 MeV does not exist. Many of the results are based on a multilevel R–matrix analysis; this is also extended to the published ${}^{16}$O(n, n) and ${}^{13}$C($\alpha$, n) cross sections for energies corresponding to ${}^{17}$O excitations up to 9.5 MeV. This extension shows that there are two levels rather than only one near 8.47 MeV and that the 9.42–MeV level has $J^\pi = (3/2)^-$. Other assignments are confirmed. The most accurate excitation energies below 9.5 MeV are reviewed from the literature and the ${}^{17}$O–${}^{17}$F mirror structure is reviewed. (auth)

## Nuclear Properties and Reactions, 20 ≤ A ≤ 38

*Refer also to abstracts 1371, 1486, 1589, 1603, 1641, 1716, 1761, and 1764.*

**1622** (t,p) AND τ,p) REACTIONS TO $0^+$ ISOBARIC ANALOG PAIRS. Garrett, J. D. (Los Alamos Scientific Lab., NM); Hansen, O. Nucl. Phys.; A212: No. 3, 600-612(1973).

The experimental data available on (${}^3$He,p) and (t,p) cross sections to isobaric analog pairs of $0^+$ states from ${}^{20}$Ne to ${}^{58}$Fe are surveyed. A distorted-wave analysis is presented, and the ratio of experimental cross sections, $r_{exp} = \sigma(^3\mathrm{He,p})/\sigma(\mathrm{t,p})$, is compared with the corresponding DWBA prediction, $r_{DW} = \sigma^{DW}(^3\mathrm{He,p})/\sigma^{DW}(\mathrm{t,p})$, for each of the 16 analog pairs. The main conclusion is that $R = r^{exp}/r^{DW}$ is significantly larger than unity. The possible reasons for this are briefly discussed. (3 figures, 4 tables) (auth)

**1623** RESEARCH ON ISOBARIC ANALOG RESONANCES IN ${}^{32}$S BY MEANS OF THE REACTIONS ${}^{31}$P(p,$\gamma$)${}^{32}$S, ${}^{31}$P(p,p)${}^{31}$P, AND ${}^{31}$P(p,$\alpha_0$)${}^{28}$Si. Vernotte, J.; Gales, S.; Langevin, M.; Maison, J. M. (Institut de Physique Nucleaire, Orsay, France). Nucl. Phys.; A212: No. 3, 493-530(1973). (In French).

Fourteen resonance levels were observed in a study of the ${}^{31}$P(p,$\gamma$)${}^{32}$S, ${}^{31}$P(p,p)${}^{31}$P, and ${}^{31}$P(p,$\alpha_0$)${}^{28}$Si reactions in the proton energy range $E_p$ = 1240 to 1600 keV. Resonance strengths were determined for thirteen resonances of the ${}^{31}$P(p,$\gamma$)${}^{32}$S reaction. The $\gamma$-ray decay schemes of ten resonances were studied by means of a Ge(Li) detector. Spin values of resonance levels and of some bound levels were obtained or confirmed by $\gamma$-ray angular distribution measurements done at seven resonances. For the thirteen resonances of the ${}^{31}$P(p,p)${}^{31}$P reaction the proton orbital momenta were determined. By combining the information from the three reactions, spins, parities, and total and partial widths were obtained for twelve resonance levels. Strong M1 transitions were observed at the $E_p$ = 1247; 1402; 1437; 1555; and 1581-keV resonances. Two T-mixed doublets were identified at $E_p$ = 1247 and 1472 keV, $J^\pi = 2^-$, and at $E_p$ = 1402 and 1469 keV, $J^\pi = 3^-$. The resonance levels at $E_p$ = 1437 and 1581 keV may be components of a third almost completely mixed doublet. The $E_p$ = 1555 keV resonance level was assigned T = 1. The $E_p$ = 1411-keV, $J^\pi = 1^+$, resonance level was identified with a level previously observed in the $\beta^+$ decay of ${}^{32}$Cl. Strong E2 transitions similar to those observed in some other doubly even s–d shell nuclei were observed between odd-parity levels of ${}^{32}$S. (11 figures, 9 tables, 59 references) (auth)

**1624** $(1f_{7/2})^2$ STATES IN ${}^{34}$S. Crozier, D. J. (Univ. of Pennsylvania, Philadelphia); Fortune, H. T.; Middleton, R.; Hinds, S. Phys. Lett., 46B: No. 2, 189-191(17 Sep 1973).

A distorted wave analysis of the ${}^{32}$S(t, p)${}^{34}$S reaction reveals that the $0^+$ state at 5.86 MeV, the $2^+$ state at 7.80 MeV and the $4^+$ state at 8.42 MeV are the principal components of the $(1f_{7/2})^2$, T = 1 multiplet. (auth)

**1625** SPECTROSCOPIC FACTORS FOR THE PROTON STATES IN ${}^{38}$AR. Ramaswamy, C. R.; Puttaswamy, N. G. (Bangalore Univ., India). Curr. Sci. (India); 42: No. 20, 714-715(20 Oct 1973).

The results of shell-model calculations of the spectroscopic factors for stripping to the excited states of ${}^{38}$Ar are tabulated. (1 table) (RWR)

**1626** POPULATION OF HIGH SPIN STATES IN ${}^{22}$Na BY MEANS OF THE ${}^{10}$B(${}^{16}$O, $\alpha$) REACTION. Gomez Del Campo, J. (Oak Ridge National Lab., TN); Ford, J. L. C. Jr.; Robinson, R. L.; Stelson, P. H.; McGrory, J. B.; Thornton, S. T. Phys. Lett., 46B: No. 2, 180-182(17 Sep 1973).

Strong selectivity was observed in the population of states in ${}^{22}$Na up to high excitation energies. Angular distributions were measured, and a comparison with Hauser-Feshbach calculations allows one to select strong candidates for the high spin members of the $K^\pi = 3^+$, T = 0 and $K^\pi = 0^+$, T = 0 bands in ${}^{22}$Na. (auth)

**1627** EFFECT OF NON-CENTRAL FORCES ON THE STRUCTURE OF S–D SHELL NUCLEI. Feldmeier, H.; Conze, M.; Manakos, P.; Wolff, T. (Technische Univ., Darmstadt, Ger.). (1973). vp. (In German).

From Spring meeting of the Deutsche Physikalische Gesellschaft. Part A, nuclear physics; Heidelberg, Germany (19 Feb 1973).

Detailed shell-model calculations have shown that states with low excitation in nuclei at the beginning of the s–d shell can be well described by means of the SU(3) model of Elliot. With increasing particle number this agreement between the predictions of the SU(3) model and the experimental data becomes worse. It is found, however, that the experimental energy spectra and the electromagnetic transition probabilities can be well reproduced if a special non-central contribution of the residual interaction is taken into account. (13 figures) (tr-auth)

**1628** ELASTIC AND INELASTIC BACKSCATTERING OF 14.2 MeV NEUTRONS FROM ${}^{28}$Si. Minetti, B. (Istituto di Fisica Sperimentale del Politecnico, Turin); Pasquarelli, A.; Bonazzola, G. C.; Bressani, T.; Chiavassa, E. Lett. Nuovo Cim.; 8: No. 4, 249-255(22 Sep 1973).

The differential cross sections and angular distributions for the elastic and inelastic backscattering of 14.2-MeV neutrons from silicon-28 are found. (JFP)

**1629** RETARDATION OF E1 TRANSITIONS AND THE NEUTRON EFFECTIVE CHARGE IN ${}^{29}$Si. Johnstone, I. P.; Castel, B. (Queen's Univ., Kingston, Ont.). Nucl. Phys.; A213: No. 2, 341-348(1973).

The effect of the giant dipole resonance on E1 transition rates is investigated, and an expression is derived which allows E1 effective charges to be calculated using the $\gamma$-absorption cross section of the neighboring even-mass core. It is shown how this expression can be approximated using a sum rule in cases where the absorption cross section is not adequately known. Application is made to ${}^{29}$Si; using wave functions from a particle-core model, calculated E1 transition rates are in excellent agreement with experiment. (auth)

**1630** MEASUREMENT AND INTERPRETATION OF HEAVY ION FUSION EXCITATION FUNCTIONS. Gutbrod, H. H.; Winn, W. G.; Blann, M. (Univ. of Rochester, NY). Nucl. Phys.; A213: No. 2, 267-284(1973).

Fusion excitation functions for ${}^{32}$S induced reactions on ${}^{24}$Mg, ${}^{27}$Al, ${}^{40}$Ca and ${}^{58}$Ni are reported at incident ${}^{32}$S ion energies of 65 to 132.5 MeV. Measurements were made using counter-telescopes with beams from Van de Graaff accelerators. From these data barrier heights and radii for fusion are extracted. These results are interpreted in terms of the nuclear diffuseness, and the nuclear attractive potentials at the fusion radii are deduced. Relative density overlaps at the fusion radius are estimated from electron scattering density distributions. Several parameterizations for the fusion radii and barrier heights are presented. Fusion cross sections are compared with reaction cross sections based on elastic scattering measurements coupled with optical model analysis. It is found that for the systems investigated, 90 ± 10% of the reaction cross section results in fusion. (auth)

**1631** ELASTIC SCATTERING OF $^{32}$S ON $^{24}$Mg, $^{27}$Al, AND $^{40}$Ca AND THE EFFECT OF NUCLEAR FORCES ON THE GRAZING COLLISION. Gutbrod, H. H. (Univ. of Rochester, NY); Blann, M.; Winn, W. G. Nucl. Phys.; A213: No. 2, 285-293(1973).

Elastic scattering of $^{32}$S ions on $^{24}$Mg, $^{27}$Al and $^{40}$Ca was measured at energies between 67 and 120 MeV. Angular distribtuions were analyzed with the optical model with Woods-Saxon potentials. Strong absorption radii are extracted with and without consideration of the nuclear interaction at the surface. The nuclear potential decreases the otherwise anomalously large strong absorption radii which can then be described by a radius parameter of $r_0$ = 1.41 fm. (auth)

**1632** NUCLEAR STRUCTURE STUDIES OF $^{20}$Ne AND $^{24}$Mg IN THE VARIATION-AFTER-PROJECTION HARTREE–FOCK METHOD. Cusson, R. Y. (Duke Univ., Durham, NC); Lee, H. C. Nucl. Phys.; A211: No. 3, 429-462(1973).

The variation-after-projection Hartree–Fock method is described. Angular momentum projection algorithms which are practical to use in small and large bases, for axially symmetric as well as asymmetric states, for doubly even, doubly odd as well as odd–even nuclei are discussed in detail. The method is successfully used to calculate the ground-band structures of $^{20}$Ne (axial) and $^{24}$Mg (nonaxial) in a five-major-shell basis with the Saunier–Pearson semirealistic N–N interaction. The operators $J^2$, $Q_2^2$, and $R_2^2$ are used as cranking constraints. Level schemes, static moments, E2 transition strengths, charge radii, elastic and inelastic electron scattering form factors are computed for the two nuclei studied. Comparisons are made with experimental data, with results obtained in other microscopic calculations, and with predictions in the rotational model. (12 figures, 8 tables) (auth)

**1633** POLARIZATION OF $^3$He ELASTICALLY SCATTERED FROM $^{27}$Al AND $^{28}$Si AT 21 MeV. Ludwig, E. J. (Univ. of North Carolina, Durham); Clegg, T. B.; Walter, R. L. Nucl. Phys.; A211: No. 3, 559-564(1973).

The polarization of 21-MeV $^3$He elastically scattered from $^{27}$Al and $^{28}$Si has been measured in an angular range of $\theta_{lab} = 25°$ to $55°$. Differential cross-section data have been obtained out to angles of approximately 100°. The small values observed in the polarization distributions differ somewhat from optical-model predictions based on fits to the differential cross-section data and cannot be used to obtain significant information about the optical-model spin–orbit potential. It is concluded that statistically significant, nonzero $^3$He polarization measurements will not be possible using traditional double scattering techniques for $^3$He energies $\leqq 27$ MeV and targets of $Z \geqq 13$. (auth)

**1634** FUSION BARRIERS IN HEAVY–ION REACTIONS. Gutbrod, H.H.; Winn, W.G.; Blann, M. (Department of Chemistry and Nuclear Structure Laboratory, University of Rochester, Rochester, New York, 14627). Phys. Rev. Lett. 30: No. 25, 1259-1262 (18 June 1973).

We present experimental fusion barriers for $^{32}$S ions on $^{24}$Mg, $^{27}$Al, $^{40}$Ca, and $^{58}$Ni. These and published data for Ar and Kr ion–induced reactions are analyzed in terms of a simple classical formula for barrier heights. A prescription based on equivalent uniform charge radii from electron scattering is shown to reproduce all results to within the experimental uncertainty. (auth)

**1635** NEUTRON POLARIZATION IN THE $^{24}$Mg($^3$He, n)$^{26}$Si REACTION AT 5.0 AND 5.8 MeV. De Martini, D.C.; Donoghue, T.R. (Department of Physics, The Ohio State University, Columbus, Ohio 43210). Phys. Rev. C 8: No. 2, 621-624 (Aug 1973).

Angular distributions of the neutron polarization have been measured for the $^{24}$Mg($^3$He, n)$^{26}$Si reaction at E($^3$He) = 5.0 and 5.8 MeV. The measurements were made using a neutron polarimeter consisting of a high–pressure helium gas scintillator and a spin–precession solenoid. The two angular distributions are similar in shape and have values approaching 0.7 at the backward angles. An attempt was made to describe $\sigma(\theta)$ and $P(\theta)$ data with direct reaction calculations made using the multinucleon transfer distorted–wave Born approximation (DWBA) code JULIE. (auth)

**1636** GAMMA-RAY DECAY IN $^{36}$Cl. Yousef, A. S.; Sprenkel-Segel, E.L. (Illinois Institute of Technology, Chicago, Illinois 60637); Segel, R.E. Phys. Rev. C 8: No. 2, 684-692 (Aug 1973).

The decays of 24 states below 4 MeV in $^{36}$Cl have been studied by use of p–γ coincidences. The excited states were populated by the $^{35}$Cl(d, p) reaction with 3.5–MeV deuterons bombarding enriched $PbCl_2$ targets. Branching ratios were determined and the mean lives of the states were measured by the attenuated–Doppler–shift method. While the level scheme is complex, it is possible to discuss many of the transitions in terms of simple shell–model configurations. Radiative rates among some of the lowest levels are compared with a recent shell–model calculation. (auth)

**1637** POSSIBLE RECOIL EFFECTS IN ($^{16}$O,$^{15}$N) TRANSITIONS ABOUT 10 MeV ABOVE THE COULOMB BARRIER. Lewis, T.J.; Wedberg, G.H.; Peng, J.C.; Ricci, J.L.; Cheng, C.M.; Maher, J.V. (Nuclear Physics Laboratory, University of Pittsburgh, Pittsburgh, Pennsylvania 15260). Phys. Rev. C 8: No. 2, 678-683 (Aug 1973).

The reactions $^{26}$Mg($^{16}$O,$^{15}$N)$^{27}$Al and $^{30}$Si($^{16}$O,$^{15}$N)$^{31}$P have been studied at an $^{16}$O beam energy of 42 MeV. Spectroscopic factors for all observed transitions have been extracted using the no–recoil distorted-wave Born approximation. For $J^\pi = (5/2)^+$ and $(1/2)^+$ states, the relative spectroscopic factors agree well with those derived from ($^3$He,d) studies. For $J^\pi = (3/2)^+$ states, the ($^{16}$O, $^{15}$N) spectroscopic factors disagree by a factor of ≈ 5 with those derived from ($^3$He,d) studies. As suggested by Kovar et al., this may be a result of neglecting recoil effects. The above factor of ≈ 5 discrepancies are of the same order as those noted ≈ 40 MeV above the Coulomb barrier by Kovar et al. (auth)

**1638** NEUTRON PICKUP FROM $^{27}$Al. Betts, R.R.; Fortune, H.T. (Physics Department, University of Pennsylvania, Philadelphia, Pennsylvania 19174); Pullen, D.J. Phys. Rev. C 8: No. 2, 670-677 (Aug 1973).

52 levels below $E_x$ = 6.8 MeV in $^{26}$Al were populated with the $^{27}$Al($^3$He,α) reaction at a bombarding energy of 18 MeV. Angular distributions for 37 levels were extracted and compared with the results of distorted-wave calculations. Of these, 28 were seen to be characteristic of direct pickup; 2 with $l_n = 0$, 3 with $l_n = 1$, 10 with $l_n = 0 + 2$ and 13 with $l_n = 2$. A comparison with the results of the $^{27}$Al(d, $^3$He)$^{26}$Mg reaction shows good agreement for known T = 1 states and allows several new T = 1 assignments to be made. Spectroscopic factors for several of the low–lying states are in good agreement with shell–model predictions. (auth)

**1639** COUPLED–CHANNEL–BORN–APPROXIMATION ANALYSIS OF "ALLOWED" AND "FORBIDDEN" $^{22}$Ne(p,t)$^{20}$Ne TRANSITIONS. Olsen, D.K.; Udagawa, T.; Tamura, T. (Center for Nuclear Studies, University of Texas, Austin, Texas 78712); Brown, R.E. Phys. Rev. C 8: No. 2, 609-620 (Aug 1973).

The effects of inelastic excitations on the $^{22}$Ne(p,t)$^{20}$Ne reaction are investigated. Differential cross sections at a proton energy of 39.8 MeV were measured for $^{22}$Ne(p,t)$^{20}$Ne transitions to the $0^+$, $2^+$, and $4^+$ members of the ground–state rotational band, to the $2^-$ and $3^-$ members of the excited $K^\pi = 2^-$ band; and to the $0^+$ and $2^+$ members of the first excited $K^\pi = 0^+$ band. The cross sections to members of the ground–state band are compared with distorted–wave Born–approximation (DWBA) and coupled–channel–Born–approximation (CCBA) calculations using both pure Nilsson and pairing–mixed Nilsson rotational wave functions. Only the CCBA calculation with pairing provides a reasonable description of the experimental data. The effects of multistep processes are found to be as large for neon as for rare–earth nuclei. The shape and relative strength of the measured cross section to the $2^-$ state, a transition which is forbidden by a direct single–step process, are reproduced well by the CCBA calculation, which allows the excitation of the $2^-$ state by inelastic processes in the entrance and exit channels. (auth)

**1640** NEUTRON PICKUP FROM $^{36}$Ar. Betts, R.R.; Fortune, H.T.; Middleton, R. (Physics Department, University of Pennsylvania, Philadelphia, Pennsylvania 19174). Phys. Rev. C 8: No. 2, 660-669 (Aug 1973).

The $^{36}$Ar($^3$He,α)$^{35}$Ar reaction has been studied at a bombarding energy of 18 MeV using a multiangle spectrograph and a windowless gas cell. Levels in $^{35}$Ar have been observed up to 8.3 MeV excitation with an energy resolution of 35 keV. Many new levels are reported. Angular distributions for the strong states have been compared with distorted–wave predictions. Spectroscopic factors have been extracted and are compared with the results of recent shell–model calculations. The agreement is good. (auth)

## Nuclear Properties and Reactions, $39 \leq A \leq 58$

*Refer also to abstracts 1622, 1634, 1661, 1671, 1673, 1674, 1685, and 1773.*

1641 (ITEF-844) $^{28}$Si, $^{47,49}$V NUCLEI INVESTIGATION IN (d,n) REACTIONS. Okorokov, V. V.; Serezhin, V. M.; Smotryaev, V. A.; Tolchenkov, D. L.; Trostin, I. S.; Cheblukov, Yu. N.; Zolotarev, V. S.; Romanov, V. S. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Moscow. Institut Teoreticheskoi i Eksperimental'noi Fiziki). 1971. 20p. (In Russian). INIS.

A study was made of the proton states of the nuclei $^{28}$Si, $^{47}$V, and $^{49}$V in (d,n) reactions. The energy of the neutrons was determined by time of flight. The experimental results were compared with those calculated by the distorted-wave method. (4 figures) (tr-auth)

1642 γ-RAY DECAY PROPERTIES OF ANALOG STATES IN $^{52}$Cr VIA THE REACTION $^{51}$V(p,γ)$^{52}$Cr. Faini, G.; Ezell, R. L.; Wills, E. L.; Scott, H. L.; Love, W. G. (Univ. of Georgia, Athens). Nucl. Phys.; A212: No. 3, 541-555(1973).

The γ-ray spectra emitted following proton capture by $^{51}$V were measured as a function of incident proton energy. The γ-ray decay of the states was observed and angular distributions were measured. The measured branching ratios and excitation energies suggest that these states in $^{52}$Cr are analogs of low-lying states in $^{52}$V. These states assumed to be analogs, the measured mixing ratios, branching ratios, and normalized decay rates are compared with shell-model calculations. Qualitative agreement with the mixing and branching ratios is obtained, but the inclusion of $2p_{1/2}$ and $1f_{5/2}$ neutron excitations appears essential if the decay rates are to be described. (6 figures, 2 tables) (auth)

1643 EFFECT OF VECTOR AND TENSOR FORCES IN THE EXCITATION OF $f_{7/2}-d_{3/2}^{-1}$ STATES IN THE $^{40}$Ca(p, p′)$^{40}$Ca* REACTION. Petrovich, F. (Univ. of California, Berkeley); Schaefer, R.; McManus, H.; Gruhn, C. R.; Kuo, T. Y. T.; Preedom, B. M.; Maggiore, C. J. Phys. Lett., 46B: No. 2, 141-144(17 Sep 1973).

The results of microscopic distorted wave approximation calculations for $f_{7/2}-d_{3/2}^{-1}$ excitations in the $^{40}$Ca(p,p′)$^{40}$Ca* reaction are presented. A "realistic" effective interaction with central, tensor, and spin-orbit components is considered. Some evidence for the tensor force is found in the data from a recent experiment. (auth)

1644 PREDICTIONS OF THE COEXISTENCE MODEL FOR THE REACTION $^{42}$Ca(p, t)$^{40}$Ca. Erikson, T.; Horsfjord, V.; Nilsson, B. (Nordita, Copenhagen). Phys. Lett., 46B: No. 2, 173-176(17 Sep 1973).

The coexistence model as formulated by Gerace and Green for $^{40}$Ca was shown to predict cross sections for the reaction $^{42}$Ca(p, t)$^{40}$Ca in strong disagreement with experiment. It is demonstrated how a much improved agreement can be obtained by introducing additional kinds of basis states. Especially important are triaxially deformed components, which contain admixtures of the $1s_{1/2}$ state. (auth)

1645 LEVEL SCHEME OF $^{47}$V FROM THE γ-DECAY OF ANALOG RESONANCES. Schrader, M. (Univ., Hamburg); Buchholz, K.; Klapdor, H. V. Nucl. Phys.; A213: No. 1, 173-199(1973). (In German).

A high-accuracy investigation of the level scheme of $^{47}$V was performed using the $^{46}$Ti(p, γ)$^{47}$V reaction. The γ-decay schemes of the strong (p, γ) resonances at $E_p$ = 1546, 1549, 1565, and 1572 keV lead to 17 new energy levels in $^{47}$V with excitation energies between 2.7 and 5.1 MeV. From the (p, γ) angular distributions mixing ratios of the primary γ transitions and $J^\pi$ values of the resonances and of many states populated in the γ decay were determined. The total width of the $E_p$ = 1549-, 1565-, and 1572-keV resonances for γ decay were found to be $\Gamma_\gamma$ = 0.12, 0.15, and 0.03 eV, respectively. The Q value of the $^{46}$Ti(p, γ)$^{47}$V reaction was found to be 5168.6 keV. The two resonances at $E_p$ = 1549 and 1565 keV, which have $J^\pi = 3/2^-$, are interpreted as fine-structure components of the analog state of the $E^*$ = 2.545 MeV, $J^\pi = 3/2^-$ level in $^{47}$Ti; while the (7/2) resonance at $E_p$ = 1546 keV might correspond to the $E^*$ = 2.615 MeV, $7/2^-$ parent state in $^{47}$Ti. The analog–antianalog M1 transition strength of the split $3/2^-$ analog state is 0.01 single-particle units, and fits well into the systematics of IAS → AIAS transitions in fp-shell nuclei. (12 figures, 5 tables) (auth)

1646 PAIRING DEFORMATION IN ISOSPACE AND GAUGE SPACE. Bes, D. R. (Comision Nacional de Energia Atomica, Buenos Aires). Rev. Brasil. Fis.; 2: No. 1, 255-268(Mar 1972).

From international symposium on nuclear structure; Sao Paulo, Brazil (8 Nov 1971).

A transformation model (rotation) to study the pairing of particles is presented. The model is used for the range of mass around $^{56}$Ni. The collective T = 1 pairing degree of freedom within the adiabatic approximation is treated. The formalism is similar to the one corresponding to the quadrupole degree of freedom. By comparing the two formalisms it is better understood which properties are inherent to a collective treatment of the many-body problem and which are inherent to the particular symmetry. (auth)

1647 HIGH-RESOLUTION PROTON SCATTERING ON $^{50}$Ti. Prochnow, N. H. (Univ. of Wisconsin, River Falls); Newson, H. W.; Bilpuch, E. G.; Mitchell, G. E. Nucl. Phys.; A213: No. 1, 134-146(1973).

Differential cross sections were measured for $^{50}$Ti(p, p) at four angles for $E_p$ = 1.83 to 2.97 MeV, with an overall energy resolution of about 350 eV. Spins, parities, and total widths were extracted for 212 levels. An energy region near $E_p$ = 1.37 MeV was also examined in order to study the analog of the ground state of $^{51}$Ti. Coulomb energies and spectroscopic factors were determined for the analogs of the ground and first excited states of $^{51}$Ti. The latter analog was highly fragmented. The s-wave spacing and width distributions were analyzed, and the number of missing levels was estimated. The $s_{1/2}$ and $p_{1/2}$ proton strength functions were determined. (6 figures, 4 tables) (auth)

1648 SEARCH FOR $^{55}$Ni. Diksic, M.; McMillan, D. K.; Stein, G. E.; Yaffe, L. (McGill Univ., Montreal). J. Inorg. Nucl. Chem.; 33: No. 11, 3954-3955(Nov 1973).

Proton irradiations of Co and Ni foils at energies calculated to produce $^{55}$Ni showed no activity with a half-life greater than 2.5 sec attributable to this nuclide. This is consistent with a short-lived high energy $\beta^+$ transition directly to the ground state of $^{55}$Co, as is the case with many other mirror nuclei. (auth)

1649 NEUTRON CORRELATIONS IN THE $^{41}$K GROUND STATE AND T = 1,2p–2h STATES IN $^{40}$K. Williams, M. E. (Rutgers-The State Univ., New Brunswick, NJ); Kruse, T. H.; Goode, P.; Baker, F. T.; Matthews, J. L.; Savin, W. Nucl. Phys.; A213: No. 2, 317-331(1973).

Differential cross sections were measured for $^{41}$K(d,t)$^{40}$K and $^{41}$K(p,d)$^{40}$K at 15 MeV using a magnetic spectrograph with electronic detection by proportional-counter-scintillator telescopes or semiconductor detectors. Knowledge of the structure of the $^{40}$K multiplets ($\nu f_{7/2}$, $\pi d_{3/2}^{-1}$) and ($\nu p_{3/2}$, $\pi d_{3/2}^{-1}$) permits the determination of amplitudes and relative phases for various configurations and neutron correlations in the $^{41}$K ground state. Spectroscopic factors for neutron pick-up to states in $^{40}$K are strongly influenced by the interference of transition amplitudes. In the (d,t) reaction T = 1, 2p–2h states are also observed. (auth)

1650 IS ($^{16}$O,$^{12}$C) AN α-TRANSFER REACTION? DeVries, R. M. (Univ. of Washington, Seattle). Nucl. Phys.; A212: No. 1, 207-213(1973).

Using a DWBA code which exactly includes finite-range and recoil effects, calculations are shown for $^{12}$C($^{16}$O, $^{12}$O)$^{16}$O, $^{40}$Ca($^{16}$O, $^{12}$C)$^{44}$Ti and $^{40}$Ca($^{6}$Li, d)$^{44}$Ti which seem to be in quantitative agreement with the assumption that these reactions proceed via the simple one-step transfer of an α particle. (5 figures, 1 table) (auth)

1651 ANALOG RESONANCES IN $^{48,50}$Ti + p REACTIONS. Rossi Alvarez, C.; Vingiani, G. B. (Univ., Padua). Nuovo Cim.; 17A: No. 4, 721-734(21 Oct 1973).

The analog states of the 1.72 MeV $J^\pi = 1/2^-$ level in $^{49}$Ti and of the $J^\pi = 3/2^-$ $^{51}$Ti ground state are studied via the (p,p) and (p, γ) reactions on $^{48}$Ti and $^{50}$Ti, respectively. Partial and total widths are given and spectroscopic factors are calculated. The elastic proton widths $\Gamma_p$ correspond well with the results obtained from (d,p) reactions on the same target nuclei. The strengths and γ-ray branching ratios of the above-mentioned resonances, together with the doublet at $E_p$ = 1007 and 1013 keV split-analogue of the 1384 keV level in $^{49}$Ti ($J^\pi = 3/2^-$) have been studied. Excitation energies and branching ratios of $^{49}$V and $^{51}$V bound states are also given. The results are compared with the ones obtained from other similar investigations. (auth)

1652 ISOBARIC ANALOG OF THE LOWEST $3/2^-$ STATE OF $^{48}$Ca. Bergdolt, G.; Bergdolt, A. M. (CRN, Strasbourg). Nucl. Phys.; A211: No. 3, 486-492(1973).

The 8.113- and 8.130-MeV states of $^{48}$Sc have been identified as the main components of the split isobaric analog of the lowest $3/2^-$ state of $^{48}$Ca. A group of $^{48}$Sc levels around 4.5 MeV is strongly excited in the γ decay. The total M1 strength has the expected order of magnitude. (4 figures, 1 table) (auth)

1653 MASS DISCREPANCY IN THE IRON REGION. Goss, J.D.; Browne, C.P.; Rollefson, A.A. (University of Notre Dame, Notre Dame, Indiana, 46556). Phys. Rev. Lett. 30: No. 25, 1255-1257 (18 June 1973).

We have found an indication of systematic discrepancies in the tabulated mass values in the iron region. We have measured the Q value for $^{58}Ni(p,\alpha)^{55}Co$ and found it to be $-1.3410 \pm 0.0029$ MeV. This differs by 17.3 keV from the value of $-1.3583 \pm 0.0045$ MeV calculated from the 1971 mass tables. (auth)

**1654** DECAYS OF $^{39}Ca$ AND $^{41}Sc$. Alburger, D.E. (Brookhaven National Laboratory, Upton, New York 11973); Wilkinson, D.H. Phys. Rev. C 8: No. 2, 657-659 (Aug 1973).

The decays of $^{39}Ca$ and $^{41}Sc$ have been studied because of the related interest in the magnitude of the axial coupling constant in nuclear matter. $^{39}Ca$ was produced in the $^{39}K(p, n)^{39}Ca$ reaction at $E_p = 10$ MeV and its half–life was measured as $860.4 \pm 3.0$ msec resulting in an ft value of $4283 \pm 25$ sec. The half–life of $^{41}Sc$, formed in the $^{40}Ca(p, \gamma)^{41}Sc$ reaction with 3–MeV protons on thick Ca, is $596.3 \pm 1.7$ msec. From the γ–ray energies of $2882.6 \pm 0.3$ keV and $3696.9 \pm 0.5$ keV measured at the 1.84– and 2.68–MeV resonances the Q value of the $^{40}Ca(p, \gamma)$–$^{41}Sc$ reaction is found to be $1085.7 \pm 1.4$ keV. This leads to a $^{41}Sc$ mass excess of $-28642.2 \pm 1.7$ keV, to a $^{41}Sc$ decay energy of $6494.9 \pm 2.0$ keV, and to an $\bar{ft}$ value of $2849 \pm 9$ sec. An upper limit of $2 \times 10^{-3}$ is placed on the β branching of $^{41}Sc$ to excited states of $^{41}Ca$. If the free–space value of $g_A$ is used to extract the Gamow–Teller matrix element $<\sigma>_{exp}$ from these data we find $<\sigma>_{exp}/<\sigma>_{s.p.}$ values of $0.685 \pm 0.009$ and $0.761 \pm 0.006$ for $^{39}Ca$ and $^{41}Sc$, respectively, where the $<\sigma>_{s.p.}$ are the relevant single–particle matrix elements. (auth)

**1655** INFLUENCE OF J–DEPENDENT ABSORPTION ON THE INELASTIC SCATTERING OF α PARTICLES. Cramer, J.G.; Eberhard, K.A.; Eck, J.S.; Trombik, W. (Sektion Physik der Universität München, 8046 Garching, Germany). Phys. Rev. C 8: No. 2, 625-628 (Aug 1973).

Coupled–channel calculations including angular momentum dependence in the absorptive part of the optical potential have been performed for the elastic and inelastic scattering of α particles from $^{40}Ca$ where J–dependent absorption might be expected. For the case of $^{40}Ca$ (α, α') at $E_\alpha = 29$ MeV it is found that the inelastic cross sections calculated without J–dependent absorption fail to predict the experimental differential cross sections by 2 orders of magnitude at backward angles while the inclusion of J–dependent absorption leads to predictions which are in good qualitative agreement with the data at all angles. (auth)

**1656** SHELL-MODEL SPECTROSCOPY OF f-p-SHELL NUCLEI WITH $A \leq 44$. McGrory, J.B. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). Phys. Rev. C 8: No. 2, 693-710 (Aug 1973).

The properties of all f–p–shell nuclei with $42 \leq A \leq 44$ have been calculated from one consistent shell model. The model space includes all Pauli–allowed states for all configurations of two, three, or four particles distributed among the four f–p shell orbits. The model Hamiltonian is a one-body plus two-body operator very similar to the "realistic" effective Hamiltonian of Kuo and Brown. Calculated results are given for excitation energies, single–particle transfer spectroscopic factors, electric–quadrupole and magnetic dipole moments, and B(M1)'s and B(E2)'s for transitions between low–lying states. The calculated results are in fair agreement with experimental information on these various observables. The results suggest that core–excitation effects are more important in the lower half of the $f_{7/2}$ shell than in the s–d shell. (auth)

**1657** HIGH–RESOLUTION STUDY OF $^{48}Ca(p,t)^{46}Ca$ at $E_p$ = 39 MeV. Crawley, G.M.; Miller, P.S. (Cyclotron Laboratory and Physics Department, Michigan State University, East Lansing, Michigan 48823); Igo, G.J.; Kulleck, J. Phys. Rev. C 8: No. 2, 574-580 (Aug 1973).

The $^{46}Ca$ nucleus was studied using the (p,t) reaction. A number of spin–parity assignments are clarified for the low–lying states. Many new energy levels are reported up to an excitation energy of 6.3 MeV including an additional $0^+$ state at 4.76 MeV. Distorted–wave calculations with f–p shell wave functions give reasonable agreement for the first $0^+$, $2^+$, $4^+$, and $6^+$ states and for two weak $0^+$ states near 5.5 MeV which were strongly excited in the $^{44}Ca(t,p)$ reaction. (auth)

**1658** PHOTON SPECTRUM FROM RADIATIVE μ CAPTURE IN CALCIUM. Rosenstein, L.M.; Hammerman, I.S. (Columbia University, New York, New York 10027). Phys. Rev. C 8: No. 2, 603-608 (Aug 1973).

We have measured the high–energy end of the γ–ray spectrum from radiative muon capture in calcium. This accounted for only about one half of the neutral events detected beyond 57 MeV, the rest apparently being due to neutrons emitted by nuclei after capture. By fitting a theoretical prediction of the photon spectrum to our data, we found a value for the induced pseudoscalar coupling constant which disagrees with that expected. (auth)

**1659** ISOMERIC LEVEL OF $^{50}Mn$. McKenna, C.M.; Kemper, K.W.; Nelson, J.W. (Department of Physics, The Florida State University, Tallahassee, Florida 32306). Phys. Rev. C 8: No. 2, 711-714 (Aug 1973).

The separation energy between the two isomeric states in $^{50}Mn$ has been determined to be $247^{+13}_{-23}$ keV by measuring the (p, n) threshold energies for the onset of the 0.29–sec and 1.76–min activities with the longer–lived state lying above the short–lived state. The $\beta^+$ decay modes of the 1.76–min level in $^{50}Mn$ are consistent with the $5^+$, T = 0 assignment given to the $227 \pm 10$–keV level previously observed via $^{50}Cr(^3He, t)^{50}Mn$ indicating that the levels observed in the two experiments are the same. (auth)

**1660** NUCLEAR REACTIONS OF V WITH 300–GeV PROTONS AND Co with 11.5–, 200–, and 300–GeV PROTONS. Katcoff, S. (Brookhaven National Laboratory, Upton, New York, 11973); Kaufman, S.B.; Steinberg, E.P.; Weisfield, M.W.; Wilkins, B.D. Phys. Rev. Lett. 30: No. 24, 1221-1223 (11 June 1973).

Cross sections of a large variety of spallation products from V and Co do not change appreciably as the beam energy increases from 11.5 to 300 GeV. The mean ratio $\sigma_{300}/\sigma_{29}$ for V is $0.96 \pm 0.04$; for Co, $\sigma_{200}/\sigma_{11.5} = 0.95 \pm 0.06$ and $\sigma_{300}/\sigma_{11.5} = 1.02 \pm 0.09$. It was assumed that the monitor cross section is constant above 10 GeV. (auth)

**1661** TEST OF THE INDEPENDENCE HYPOTHESIS AND ISOSPIN CONSERVATION IN COMPOUND-STATISTICAL REACTIONS. Wiley, J.; Pacer, J. C.; Lux, C. R.; Porile, N. T. (Purdue Univ., Lafayette, IN). Nucl. Phys.; A212: No. 1, 1-17 (1973).

Energy spectra and angular distributions of protons and α particles emitted in the decay of $^{56}Fe$, $^{60}Ni$, $^{63}Cu$, $^{64}Zn$, and $^{66}Zn$ were measured. These compound nuclei were produced with a given excitation energy by irradiation of appropriate targets with 14.0-MeV protons and 15- to 19-MeV α particles. The proton spectra featured a low-energy peak ascribable to the (p, np) or (α, np) reaction, as well as a higher energy peak due to the (p,p') or (α, p) reaction. These peaks were sufficiently well resolved that differential cross sections could be obtained for the p, np, as well as α exit channels. The α and np exit channels were found to be free of precompound effects and are not affected by isospin conservation. Comparison of these particular cross sections for both entrance channels permits a test of the independence hypothesis provided a correction is made for the different angular momentum distributions in the entrance channels. When this correction is applied on the basis of the spin-dependent statistical theory, it is found that the independence hypothesis is confirmed in all cases. Comparison of the p and α exit channels leads to values of the isospin mixing fraction, μ, between the $T_>$ and $T_<$ states of the compound nucleus. The values of μ are $0.4 \pm 0.2$ for all five compounds nuclei, and correspond to Coulomb mixing widths whose value is approximately 20 keV. (8 figures, 4 tables) (auth)

# Nuclear Properties and Reactions, $59 \leq A \leq 89$

*Refer also to abstracts 1371, 1660, 1685, 1691, 1713, 1729, 1736, 1746, 1762, and 1764.*

**1662** (ANL/NDM-1) COBALT FAST NEUTRON CROSS SECTIONS: MEASUREMENT AND EVALUATION. Guenther, P. T.; Moldauer, P. A.; Smith, A. B.; Smith, D. L.; Whalen, J. F. (Argonne National Lab., Ill. (USA)). Jul 1973. Contract W-31-109-eng-38. 108p. Dep. NTIS $7.50.

Elastic and inelastic scattering cross sections of cobalt were measured from incident energies of 1.8 to 4.0 MeV including those for the excitation of states at $1.10 \pm 0.01$, $1.20 \pm 0.01$, $1.30 \pm 0.01$, $1.43 \pm 0.01$, $1.46 \pm 0.02$, $1.72 \pm 0.02$, $2.06 \pm 0.02$, $2.09 \pm 0.02$, $2.16 \pm 0.03$, $2.35 \pm 0.05$, and $2.50 \pm 0.05$ MeV. Total neutron cross sections were measured from ≈ 2.0 to 4.5 MeV. From the experimental results, and previously reported values, an optical—statistical model was deduced, providing a quantitative description of measured values to 20.0 MeV. The observed excited structures and cross sections are shown consistent with a nuclear structure model based upon a proton hole in the $f_{7/2}$ shell strongly coupled to a spherical core, and a solution of previous ambiguities in $J^\pi$ assignments is suggested. The available experimental information and the computational model are used to provide a comprehensive evaluated data file in the ENDF format suitable for use in fission reactor, fusion reactor, and other applied neutronic calculations. This evaluated file is explicitly presented in the Appendix. (18 figures, 2 tables, 103 references) (auth)

**1663** (INR–1466) LIGHT RESIDUAL NUCLEI PRODUCED IN THE INTERACTIONS OF 25 GeV/c PROTONS WITH Ag AND Br NUCLEI. Sieminska, J.; Brzezinska, D. (Institute of Nuclear

Research, Warsaw (Poland)). 1973. 12p. Dep. NTIS (U. S. Sales Only) $3.00.

Analysis of low energy products of interactions of 25-GeV/c protons with Ag and Br nuclei shows the existence of light residual nuclei ($A \lesssim 10$) in as much as about 30% of reactions containing $^{8}$Li fragments and only in about 5% of randomly chosen reactions. The observed differences between these two samples of interactions seem to be connected with the difference in the average numbers of emitted nuclei. (auth)

**1664** CROSS-SECTION MEASUREMENTS FOR THE $^{75}$As($\alpha$,2n)$^{77}$Br REACTION. Waters, S. L.; Nunn, A. D.; Thakur, M. L. (Hammersmith Hospital, London). J. Inorg. Nucl. Chem.; 35: No. 10, 3413-3416(Oct 1973).

Cross-sections have been determined experimentally for the $^{75}$As($\alpha$,2n)$^{77}$Br reaction for incident particle energies of 13.8 to 28.1 MeV using the MRC cyclotron at Hammersmith Hospital. The cross-sections have been tabulated, and the excitation function has been plotted. Upper limits for the cross-section of the $^{75}$As($\alpha$,3n)$^{76}$Br and $^{75}$As($\alpha$,2pn)$^{76}$As reactions are also given for an incident energy of 28.1 MeV. (auth)

**1665** STUDY OF THE LEVEL SCHEME OF $^{74}$As BY THE $^{74}$Ge(p,n$\gamma$)$^{74}$As REACTION. Kimura, K. (Kyushu Univ., Fukuoka). Nucl. Phys.; A213: No. 1, 61-81(1973).

A level scheme of $^{74}$As up to about 700 keV excitation energy was determined by threshold energy measurements on the reaction $^{74}$Ge(p,n$\gamma$)$^{74}$As. For eleven levels below 465.3 keV, spins and parities were assigned by using transition multipolarities obtained from the observed internal conversion coefficients and by comparing relative cross sections for the (p,n) reactions leading to various residual levels with those predicted by Hauser-Feshbach theory. (auth)

**1666** RADIOCHEMICAL IDENTIFICATION OF $^{70}$Cu. Szalay, A.; Jost, K. (Inst. of Nuclear Research, Debrecen, Hungary). Radiochem. Radioanal. Lett.; 15: No. 1, 57-63 (20 Sep 1973).

After bombarding an enriched $^{70}$Zn target with 14-MeV neutrons, $^{70}$Cu was identified by means of a rapid radiochemical separation method. The 42 ± 3 s activity previously observed belongs to $^{70}$Cu. Systematic comparison of its half-life with those of neighboring comparable (odd−odd) nuclei demonstrates, however, that this is an isomeric state of $^{70}$Cu and the 5 ± 1 s activity belongs to the ground state of $^{70}$Cu. The activation cross section of the $^{70m}$Cu state amounts to 4 ± 3 mb (max. error). (1 figure) (auth)

**1667** MOESSBAUER SPECTROMETRY WITH $^{61}$Ni. Lafaut, J. P. Louvain, Belg.; Univ. Louvain (1973). vp. (In Dutch). Centre d'Etude de l'Energie Nucleaire, Mol, Belg.

Thesis.

A Moessbauer spectrometer, the measurements performed, and the precision attained are described. The ratio of the magnetic moments of the first excited level and the ground state of $^{61}$Ni was studied by measuring the hyperfine structure of the magnetic field in certain alloys. The disagreement of the magnetic moments is too great to be explained by a quadrupole interaction. Attempts were made to obtain better agreement by using a spin−spin interaction. (tr-BE)

**1668** NEW $\gamma$-RAY CASCADE MODEL FOR ISOMERIC RATIO CALCULATIONS. Clarke, R. L.; Gill, D. R. (Carleton Univ., Ottawa). Nucl. Phys.; A213: No. 2, 349-357(1973).

A new $\gamma$-ray cascade model for predicting isomeric ratios is described. This model employs nuclear level densities generated numerically with a computer program designed by Hillman and Grover. Isomeric state production ratios in $^{69}$Zn, $^{80}$Br, $^{81}$Se and $^{165}$Dy were measured for the (n,$\gamma$) reaction as a function of neutron energy. The results are compared to the predictions of the model. (auth)

**1669** ISOSPIN COMPONENTS OF THE GIANT DIPOLE RESONANCE IN SEVERAL GERMANIUM ISOTOPES. McCarthy, J. J.; Morrison, R. C.; Vander Molen, H. J. (Ames Lab., IA). Nucl. Phys.; A213: No. 2, 371-382(1973).

Measurements of the ($\gamma$,np) cross sections of $^{70}$Ge, $^{72}$Ge, $^{74}$Ge and $^{76}$Ge and the ($\gamma$,p) cross section of $^{74}$Ge are reported. The ($\gamma$,np) reaction is discussed as a channel for the observation of the $T = T_0 + 1$ component of the giant dipole resonance of the nuclear photo effect, and experimental evidence is presented in support of this conjecture in Ge isotopes. (auth)

**1670** PHOTOPROTON CROSS SECTION AND ISOSPIN COMPONENTS OF THE GIANT RESONANCE IN $^{64}$Zn. Clark, G. E.; Morrison, R. C.; Baglin, J. E. E.; Cock, B. C. (Ames Lab., IA). Nucl. Phys.; A213: No. 2, 358-370(1973).

The absolute cross section for the reaction $^{64}$Zn($\gamma$,p)$^{63}$Cu using a thin target of 99.6% isotopically pure $^{64}$Zn was measured at four angles using bremsstrahlung from the Los Alamos Electron Prototype Accelerator. The results are compared with the previously measured $^{64}$Zn($\gamma$,n)$^{63}$Zn cross section to clearly show the two isospin components of the giant dipole resonance. The measured photoproton cross section is combined with previously measured ($\gamma$,n), ($\gamma$,2n) and ($\gamma$,np) results to obtain a "total" photodisintegration cross section for $^{64}$Zn. (auth)

**1671** ANOMALOUS AND NORMAL ANGULAR DISTRIBUTIONS IN Ni($^{18}$O, $^{16}$O) REACTIONS. Auerbach, E.H.; Baltz, A.J.; Bond, P.D.; Chasman, C.; Garrett, J.D.; Jones, K.W.; Kahana, S.; LeVine, M.J.; Schneider, M.; Schwarzschild, A.Z.; Thorn, C.E. (Brookhaven National Laboratory, Upton, New York, 11973). Phys. Rev. Lett. 30: No. 21, 1078-1082 (21 May 1973).

Differential cross sections are measured for $^{58,60,62,64}$Ni($^{18}$O, $^{16}$O) reactions to both ground and excited ($2^+$) states of the residual Ni nuclei at incident $^{18}$O laboratory energies of 65, 57, and 50 MeV. Anomalous, forward-rising, angular distributions are seen for $^{58,60}$Ni($^{18}$O, $^{16}$O) reactions, in contrast to normal heavy-ion-induced transfer shapes obtained for the heavier Ni targets. A theoretical explanation is presented based on a weaker absorption than is usually employed for such heavy-ion transfer reactions. (auth)

**1672** INTERFERENCE MAXIMA IN THE BACKWARD EXCITATION CURVE OF $\alpha$-PARTICLE ELASTIC SCATTERING ON MEDIUM WEIGHT NUCLEI. Budzanowski, A.; Chyla, K.; Czabanski, R.; Grotowski, K.; Jarczyk, L.; Kamys, B.; Kapuscik, A.; Micek, S.; Ploskonka, J.; Strzalkowski, A.; Szmider, J.; Wrobel, Z.; Zastawniak, L.; Zybert, R. (Inst. of Nuclear Physics, Krakow). Nucl. Phys.; A211: No. 3, 463-472(1973).

Excitation functions for the elastic scattering of $\alpha$ particles from Ni, Co, and Cu at $\theta_{lab} = 179°$ were measured in the lab energy range 22.75 to 28.40 MeV, as well as some angular distributions for Co($\alpha$, $\alpha$). Broad maxima with a width of about 2.5 MeV were found in the excitation functions. It is shown that a simple four-parameter optical model of the interaction is able to reproduce the angular distributions as well as the excitation functions. Examination of the Argand diagrams leads to the conclusion that the maxima in the excitation curves are formed as a result of a coherent superposition of a number of partial waves, none of which behaves in itself in a resonance-like manner. (10 figures) (auth)

**1673** EFFECTIVE-INTERACTION CALCULATION ON THE ENERGY SPECTRA OF 1F-2P NUCLEI. I. Hsieh, S.T.; Wang, M.C.; H. C. Chiang; Lee, T.Y. (Institute of Physics, National Tsing Hua University, Hsinchu, Taiwan, Republic of China). Phys. Rev. C 8: No. 2, 563-573 (Aug 1973).

The energy spectra of normal-parity states of Ni isotopes are studied in the conventional shell model. The effective two-body interactions are determined by a least-squares fit between the calculated and observed low-lying energy levels. The agreement between the experimental and calculated energy spectra is quite remarkable. Single-nucleon spectroscopic factors for some low-lying states of odd-mass Ni isotopes are calculated. The resulting spectroscopic factors are similar to those calculated in other effective interaction calculations. (auth)

**1674** STRUCTURE, DIRECTIONAL-CORRELATION, AND DOPPLER-SHIFT LIFETIME MEASUREMENTS IN $^{61}$Cu VIA $^{58}$Ni($^{4}$He,p$\gamma$) REACTION SPECTROMETRY. Sarantites, D.G.; Barker, J.H.; Lu, N. (Department of Chemistry, Washington University, St. Louis, Missouri 63130); Hoffman, E.J.; Van Patter, D.M. Phys. Rev. C 8: No. 2, 629-656 (Aug 1973).

The level structure and the decay properties of the levels in $^{61}$Cu up to 4082 keV of excitation have been carefully investigated via prompt $\gamma\gamma$ and p$\gamma$ coincidence experiments employing Ge(Li) $\gamma$-ray detectors and annular Si surface-barrier charged-particle detectors. From these experiments and from high-resolution singles energy and directional-correlation measurements an improved decay scheme has been obtained which includes 44 levels in $^{61}$Cu and incorporates 120 $\gamma$ rays. New levels at 2584.5, 3739.4, 3942.4, and 4081.8 keV were postulated, while the $\gamma$ decay of several previously reported levels between 3277–3802 keV was not observed. The singles directional correlations from many transitions were used to obtain (i) reliable branching ratios for the more intense $\gamma$ rays and (ii) multipole mixing ratios $\delta$ (E2/M1) by employing both a ratio method and an independent analysis of the correlations via the compound statistical theory of nuclear reactions. Branching ratios for the weaker $\gamma$ rays were obtained from spectra taken at 55 ° to the beam direction. The lifetimes of 31 levels in $^{61}$Cu were measured by the Doppler-shift attenuation method via the $^{58}$Ni($^{4}$He, p$\gamma$) reaction at bombardment energies between 9.7 and 12.2 MeV. Lifetimes were extracted from singles spectra obtained at 0, 15, 30, 45, 70, 90, and 110 ° and from p$\gamma$ coincidence spectra obtained at 0 ° to the beam direction, by employing both a centroid shift analysis for the data from all angles and a line-shape fitting analysis for the data from angles $\leq 45$ °. The stopping power of Ni, previously calibrated for Cu ions, was used for the line-shape analysis and for obtaining reliable F($\tau$) curves applicable to the present conditions of both the singles and the coincidence experiments. For a large number of transitions in $^{61}$Cu values for B(E2) and B(M1) were obtained. The B(E2) and B(M1) values together with the $\delta$(E2/M1) values and the branching ratios from the first 10 levels in $^{61}$Cu are compared with recent detailed calculations for $^{61}$Cu based on a unified model. Good general agreement is observed between experiment and theory for the B(E2) values. Only moderate agreement between experiment and theory is observed for the B(M1) and $\delta$ (E2/M1) values. (auth)

**1675** SPALLATION OF COPPER BY 65–MeV $\pi^+$ AND $\pi^-$ AND BY 205-MeV PROTONS. Garrett, C.K.; Turkevich, A.L. (The Enrico Fermi Institute and Department of Chemistry, The University of Chicago, Chicago, Illinois 60637). Phys. Rev. C 8: No. 2, 594-602 (Aug 1973).

The spallation of copper with 65–MeV $\pi^+$ and $\pi^-$ has been investigated radiochemically by the determination of the yields of 12 product nuclides. These yields are generally comparable to those from the interaction of 205–MeV protons with copper; however, there is evidence of a higher probability of very large energy deposition by pions than by protons. For product nuclides not too far removed from the target there are often large differences in yields with $\pi^+$, p, and $\pi^-$, reflecting the different charge-to-mass ratios of the initial systems of incident particle plus target. Most of the characteristics of pion spallation are adequately reproduced by intranuclear cascade simulation calculations. (auth)

## Nuclear Properties and Reactions, $90 \leq A \leq 149$

*Refer also to abstracts 1341, 1371, 1663, 1713, 1716, 1746, and 1762.*

**1676** (ANL-AP/CTR/TM-4) FAST NEUTRON PROCESSES IN NIOBIUM: MEASUREMENTS AND EVALUATION. Smith, A. B.; Whalen, J. F.; Guenther, P. T. (Argonne National Lab., Ill. (USA)). Jan 1973. 71p. Dep. NTIS $5.75.

Neutron total and elastic and inelastic scattering cross sections of niobium are measured in the incident energy interval 0.3 to 5.0 MeV. Differential elastic neutron scattering cross sections are determined at ≈ 20 scattering angles distributed between 20 and 160 degrees. The cross sections for the inelastic neutron excitation of 11 states with Q-values of ≤ 2520 keV are quantitatively measured and the excitation of an additional 8 states qualitatively observed. The experimental results are compared with previously reported values and provide a foundation from which is deduced an optical potential suitable for the interpolation and extrapolation of the measured values. The experimental results and the associated theoretical model are used to construct an evaluated data file in the ENDF format with particular attention to fast neutron cross sections applicable to the neutronic study of fusion reactor systems. (auth)

**1677** NEW ISOMER. 84-min /sup 132m/I. Diksic, M.; Yaffe, L. (McGill Univ., Montreal). Inorg. Nucl. Chem. Lett.; 9: No. 10, 1057-1060(Oct 1973).

The discovery of a metastable isomer of 2.3 hr $^{132g}$I is described. U metal foil, or uranyl nitrate, was irradiated in the circulating beam of the McGill synchrocyclotron at energies in the range 35 to 85 MeV. The I was chemically extracted from the target and the $\gamma$-rays measured with a Ge(Li) detector. Another approach was to irradiate enriched $^{130}$Te in the Brookhaven cyclotron to produce the reaction $^{130}$Te($\alpha$,pn)$^{132}$I. Preliminary calculations showed that 86 ± 2% of $^{132m}$ I decays by isomeric transition to $^{132g}$ I and 14 ± 2% by $\beta^-$ decay to levels in $^{132}$Xe. A detailed decay scheme is in preparation. (UK)

**1678** PHOTONUCLEAR REACTIONS PERFORMED WITH MONOCHROMATIC PHOTONS IN THE AL60 ACCELERATOR. Bergere, R.; Beil, H.; Carlos, P.; Veyssiere, A. (CEN de Saclay, Gif-sur-Yvette, France). Bull. Inform. Sci. Tech. (Paris); No. 179, 81-94(Mar 1973). (In French).

Photonuclear research at Saclay is presented. The essential characteristics of the annihilation-in-flight system of monochromatic positrons producing a continuously variable monoenergetic photon beam are also given. Such a monochromatic photon beam was used mainly in photoneutron research, and the experimental results are interpreted in the framework of either microscopic or collective models. Some specific examples extracted from systematic study of the width and integrated cross section of the giant dipole resonance are presented. (FR)

**1679** NUCLEAR SPECTROSCOPY STUDIES USING THE SACLAY VAN de GRAAFF TANDEM. Fernandez, B. (CEN de Saclay, Gif-sur-Yvette, France). Bull. Inform. Sci. Tech. (Paris); No. 179, 55-65(Mar 1973). (In French).

Experiments currently in progress at the Saclay Van de Graaff tandem laboratory are reviewed. They include studies on single- and many-particle excitations, the observation of simple structures in the continuum, study of elastic scattering and high-spin states, and measurements of electromagnetic transition rates. (FR)

**1680** TWO YEARS OF EXPERIMENTS AT THE SACLAY LINEAR ACCELERATOR. Tzara, C. (CEN de Saclay, Gif-sur-Yvette, France). Bull. Inform. Sci. Tech. (Paris); No. 179, 39-54(Mar 1973). (In French).

The importance of the experiments in the field of nuclear physics with electrons and photons between 150 and 600 MeV, and with low-energy pions and muons, is underlined. The basic experimental equipment is described. The experiments in progress are reviewed. Some of those, like electron scattering, concern the classical nuclear structure, where the nucleon structure is ignored. Others concern the fields of both nuclear physics and elementary particle physics. (FR)

**1681** NUCLEAR PHYSICS DEPARTMENT OF THE SACLAY NUCLEAR RESEARCH CENTER: INTRODUCTION, ACTIVITIES, EVOLUTION. Faraggi, H. (CEN de Saclay, Gif-sur-Yvette, France). Bull. Inform. Sci. Tech. (Paris); No. 179, 5-13(Mar 1973). (In French).

A brief review of the means of the nuclear physics department at Saclay (accelerators and staff) is given. The activities of the different services are presented; they are centered on nuclear structure research using various nuclear reactions. (FR)

**1682** $^{120}$Cd AND $^{122}$Cd. Scheidemann, O.; Hageboe, E. (Univ. of Oslo). J. Inorg. Nucl. Chem.; 35: No. 9, 3055-3059 (Sep 1973).

Mass-separated samples of the new nuclides $^{120}$Cd and $^{122}$Cd have been produced by the ISOLDE-facility (isotope-separator on line with the CERN 600 MeV Synchrocyclotron). The half-life of $^{120}$Cd is 50.80 ± 0.21 sec and that of $^{122}$Cd is 5.78 ± 0.09 sec. The decays of these nuclides feed low-spin isomers of $^{120}$In (>99.9%) and $^{122}$In (>99.4%) only. The half-life of $^{120}$In is 3.08 ± 0.08 sec and that of $^{122}$In is ≤1.5 sec. Energies and intensities of $\gamma$-rays associated with the decays of the Cd-isotopes and their In daughters were measured, and proposed partial decay schemes are presented. (auth)

**1683** GAMMA RAYS FROM THERMAL NEUTRON CAPTURE IN $^{128}$Te. Yu, H. Y.; Lin, E. K.; Wang, W. N. (National Tsing Hua Univ., Hsinchu, Taiwan). Chin. J. Phys. (Taiwan); 11: No. 1, 1-17(Apr 1973)

Thermal neutron capture gamma rays from $^{128}$Te were measured by means of a 43 cm$^3$ Ge(Li) detector and a NaI(Tl) scintillator. A great number of gamma rays were identified belonging to the energy levels in $^{129}$I populated in the beta decay of $^{129}$Te from $^{128}$Te (n,$\gamma$) reaction. The detailed decay scheme of $^{129}$I was constructed. Possible transitions between levels of $^{129}$I were given and discussed. (auth)

**1684** MAGNETIC MOMENTS OF 11/2$^-$ STATES IN THE Sn REGION. Riegel, D.; Braeuer, N.; Dimmling, F.; Focke, B.; Nishiyama, K. (Freie Univ., Berlin). Phys. Lett., 46B: No. 2, 170-172(17 Sep 1973).

The relative differences of eight magnetic moments of 11/2$^-$ states in the Sn region are excellently reproduced by first-order core polarization effects calculated with the use of experimentally known energy denominators and occupation numbers. (auth)

**1685** DOUBLE BETA DECAY VIA RESONANCES IN THE NUCLEUS. Smith, D.; Picciotto, C.; Bryman, D. (Univ. of Victoria, B. C.). Phys. Lett., 46B: No. 2, 157-159 (17 Sep 1973).

Nuclear double-beta decay is calculated in a model which assumes that the $\Delta$(1236) exists in the nucleus with a probability of approximately 1%. The results obtained with this model are consistent with the observed half-lives. (auth)

**1686** SPINS AND MIXING RATIOS IN $^{138}$Ba. Singh, B.; Johns, M. W. (McMaster Univ., Hamilton, Ont.). Nucl. Phys., A212: No. 2, 382-386(1973).

The spin assignments to the 1899 ($4^+$), 2308 ($3^+$ or $4^+$) and 2446 ($3^+$) keV levels in $^{138}$Ba were confirmed by $\gamma$-$\gamma$ directional correlation measurements. In addition, the multipolarity and E2/M1 mixing parameters for a number of transitions were established as follows: 409 keV (M1 + E2, $-0.75 < \delta < -0.45$ or $-0.85 < \delta < -0.05$ depending on the choice of $J^\pi = 3^+$ or $4^+$ for the initial state), 463 keV (E2, $0 < \delta < 0.15$ for M3/E2 admixture), 547 keV (M1 + E2, $-0.06 < \delta < -0.015$), 872 keV (M1 + E2, $\delta$ undefined) and 1010 keV (M1 + E2, $-0.015 < \delta < +0.020$). (auth)

**1687** ANALYSIS OF STRIPPING TO ANALOG RESONANCES USING COMPLEX ENERGY EIGENSTATES. Coker, W. R.; Hoffmann, G. W. (Univ. of Texas, Austin). Z. Phys.; 263: No. 3, 179-190(1973).

An analysis is presented of 30.2-MeV ${}^{92}$Mo($\tau$, d)${}^{93}$Tc${}^{A}$ angular distributions for seven isobaric analog resonances in ${}^{93}$Tc${}^{A}$, using complex energy eigenstates to provide single-particle resonance state functions as form factors for the DWBA calculations. Details of the computation and use of complex energy eigenstates or Gamow functions are given, and results of the analysis are compared both with previous ${}^{92}$Mo(d, p)${}^{93}$Mo studies and with previous analyses of the isobaric analog resonances. It is stressed that Gamow functions make possible a simple and elegant description of direct reactions populating either single particle or isobaric analog resonances. (1 figure, 1 table) (auth)

**1688** NUCLEAR REACTION CROSS-SECTIONS FOR 14.7 MeV NEUTRONS ON ${}^{99}$Tc. Qaim, S. M. (Kernforschungsanlage, Juelich, Ger.). J. Inorg. Nucl. Chem.; 33: No. 11, 3669-3675 (Nov 1973).

Cross sections for 14.7 ± 0.3 MeV neutron-induced nuclear reactions on ${}^{99}$Tc were determined by the activation technique using Ge(Li) detector $\gamma$-ray spectroscopy and fast chemical separation. The results are: $\sigma$${}^{99}$Tc(n, $\gamma$)${}^{100}$Tc = 9 ± 2 mb; $\sigma$${}^{99}$Tc (n, n'$\gamma$)${}^{99m}$Tc = 107 ± 13 mb; $\sigma$${}^{99}$Tc(n, p)${}^{99}$Mo = 15.1 ± 2.28 mb; $\sigma$${}^{99}$Tc(n, $\alpha$)${}^{96}$Nb = 7.1 ± 1.0 mb; $\sigma$${}^{99}$Tc(n, n' $\alpha$)${}^{95}$Nb = 1.28 ± 0.2 mb; $\sigma$${}^{99}$Tc(n, 2p)${}^{98}$Nb ≤ 14 μb and $\sigma$${}^{99}$Tc(n, ${}^{3}$He)${}^{97}$Nb ≤ 7 μb. The cross section for the reaction ${}^{99}$Tc(n, 2n)${}^{98}$Tc is estimated from theoretical considerations to be 1227 ± 226 mb. The data are discussed with respect to the cross-section systematics at this energy. (auth)

**1689** PROTON PARTICLE STATES IN THE REGION AROUND ${}^{132}$Sn. Borg, S.; Holm, G. B.; Rydberg, B. (Research Inst. for Physics, Stockholm). Nucl. Phys.; A212: No. 1, 197-206(1973).

The decay of ${}^{133}$Sn leading to levels in ${}^{133}_{51}\mathrm{Sb}_{82}$, which has one proton outside the closed shell, was observed at the OSIRIS isotope separator on-line facility. The half-life is 1.47 ± 0.04 s, and the $d_{5/2}$ level is found at an excitation of 963 keV. The decay of (18 ± 1)-s ${}^{135}$Te to one-particle and three-particle levels in ${}^{135}_{53}\mathrm{I}_{82}$ was also studied. (9 figures) (auth)

**1690** NUCLEAR MATRIX ELEMENTS IN THE FIRST-FORBIDDEN $\beta$ DECAYS OF ${}^{122}$Sb AND ${}^{124}$Sb. Smith, H. A. Jr.; Schweitzer, J. S.; Simms, P. C. (Purdue Univ., Lafayette, IN). Nucl. Phys., A211: No. 3, 473-485(1973).

Nuclear matrix elements in the $2^{-}$(1.41 MeV $\beta^{-}$)$2^{+}$ $\beta$ decay of ${}^{122}$Sb and the $3^{-}$(2.31 MeV$\beta^{-}$)$2^{+}$ $\beta$ decay of ${}^{124}$Sb have been extracted using the formalism of Buehring. In the ${}^{124}$Sb decay, the vector matrix element ratio $\int \alpha/(\int ir/R)$ was found to be significantly smaller than the conserved vector current (CVC) prediction based upon the assumption that the Coulomb Hamiltonian is diagonal. In the ${}^{122}$Sb decay, no quantitative CVC conclusions were possible. In both $\beta$ decays the $\int iB_{ij}/R$ matrix element is dominant, while the tensor rank-one matrix elements have values approximately one order of magnitude smaller. These results can be understood on the basis of the simple shell model with configuration mixing. However, there are two experimental results which are not easy to understand. The tensor rank-zero matrix elements make a large contribution to the ${}^{122}$Sb decay, and the overall sizes of the ${}^{124}$Sb $\beta$ decay matrix elements are approximately two orders of magnitude smaller than their counterparts in the ${}^{122}$Sb decay. (6 figures, 3 tables, 65 references) (auth)

**1691** IN-BEAM ELECTRON CONVERSION FROM YRAST LEVELS OF ${}^{72,74,76,78}$Se, ${}^{78,80,82,84}$Kr, ${}^{114,116,118,120,122,124,126}$Te, AND ${}^{130,132,134,136,138}$Ce EXCITED BY ($\alpha$,xn). Wyckoff, W.G.; Draper, J.E. (Crocker Nuclear Laboratory University of California, Davis, California 95616). Phys. Rev. C 8: No. 2, 796-805 (Aug 1973).

A new in-beam electron spectrometer was used to measure electron conversion intensities of cascade transitions between yrast levels of the nuclei listed above. A few $2^{+\prime} \rightarrow 2^{+}$ transitions were also measured. Altogether, 103 electron lines were measured during and between cyclotron bursts of 25-62-MeV $\alpha$ particles. The conversion coefficients, based on $\gamma$ intensities from previous work at this laboratory, are compatible with the assignments of all but one of these transitions previously studied in this laboratory. The exception is the 1015-keV transition in ${}^{78}$Kr, earlier obscured by a 1013-keV transition due to Al. These yrast level energies are correlated with a semiempirical model. The complementary nature of measurements of in-beam angular distributions of $\gamma$ rays and measurements of electron conversion coefficients is discussed. (auth)

**1692** TWO-NEUTRON-HOLE STATES IN THE EVEN N = 80 NUCLEI. Meyer-Lévy, M. (Institut de Physique Nucléaire, Université Claude Bernard de Lyon, 69621 Villeurbanne, France); Lopac, V. Phys. Rev. C 8: No. 2, 829-833 (Aug 1973).

Properties of the even N = 80 nuclei are calculated by coupling two neutron holes to the quadrupole vibrator. Spectra and transition probabilities are compared with the available experimental data. Structure of the quadrupole moment of the $2_1^{+}$ state is discussed in terms of the individual neutron excitations, and properties of the negative-parity states are also investigated. (auth)

**1693** DECAY ENERGIES OF GASEOUS FISSION PRODUCTS AND THEIR DAUGHTERS FOR A = 138 TO 142. Adams, J.P.; Carlson, G.H.; Lee, M.A.; Talbert, W.L. Jr.; Wohn, F.K.; Clifford, J.R.; McConnell, J.R. (Ames Laboratory-USAEC and Department of Physics, Iowa State University, Ames, Iowa 50010). Phys. Rev. C 8: No. 2, 767-774 (Aug 1973).

The $\beta$-decay energies for several mass-separated Xe fission products and their daughters have been measured at the TRISTAN on-line separator facility at the Ames Laboratory Research Reactor. A well-type plastic scintillator was used in coincidence with a Ge(Li) $\gamma$ detector to determine $\beta$-group end-point energies and deduce Q values. The following $\beta$-decay energies have been determined: ${}^{138}$Xe, 2.83 ± 0.08 MeV; ${}^{138}$Cs, 5.29 + 0.07 MeV; ${}^{139}$Xe, 4.88 + 0.06 MeV; ${}^{139}$Cs, 4.29 ± 0.07 MeV; ${}^{140}$Xe, 4.06 ± 0.06 MeV; ${}^{140}$Cs, 5.8 ± 0.1 MeV; ${}^{141}$Xe, 6.0 ±20.1 MeV; ${}^{141}$Cs, 4.98 ± 0.08 MeV; ${}^{141}$Ba, 3.01 ± 0.06 MeV; ${}^{142}$Xe, 4.9 ± 0.1 MeV; and ${}^{142}$Cs, 6.89 ± 0.06 MeV. The decay energies are compared with previous measurements, systematics predictions, and two currently accepted mass relations. The energies are also used to predict the $\beta$-decay energies for seven additional nuclei by means of systematics. (auth)

**1694** NEUTRON SHELL STRUCTURE IN ${}^{125}$Sn BY (d,p) AND ($\alpha$, ${}^{3}$He) REACTIONS. Bingham, C.R. (The University of Tennessee, Knoxville, Tennessee 37916); Hillis, D.L. Phys. Rev. C 8: No. 2, 729-736 (Aug 1973).

Differential cross sections for ${}^{124}$Sn(d, p) at 33.3 MeV were measured in 5 ° increments from 12.5 to 47.5 ° lab. The resolution was about 30 keV full width at half maximum. The ($\alpha$, ${}^{3}$He) spectra with ≈ 55-keV resolution were obtained at 15 and 20 ° lab with 65.7-MeV $\alpha$ particles. Distorted-wave calculations were made, allowing the assignment of l values, some of which were not made in earlier neutron-transfer studies. Spin assignments and spectroscopic factors were obtained in accordance with the shell model. Consistent spectroscopic factors were obtained from the (d, p) and ($\alpha$, ${}^{3}$He) reactions. Sums of spectroscopic factors and centers of gravity are presented for the levels observed and are compared with the results of pairing theory. Essentially all the neutron strength remaining in the neutron shell between N = 50 and N = 82 was located. Most of the strength in the $2f_{7/2}$, $3p_{3/2}$, and $1h_{9/2}$ levels of the next major shell was located. (auth)

**1695** THE RADIOACTIVE DECAY OF ${}^{130}$I${}^{m}$, ${}^{130}$I${}^{g}$, AND ${}^{130}$Cs TO LEVELS OF ${}^{130}$Xe. Hopke, P.K.; Jones, A.G. (Department of Chemistry, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139); Walters, W.B.; Prindle, A.; Meyer, R.A. Phys. Rev. C 8: No. 2, 745-756 (Aug 1973).

The level structure of ${}^{130}$Xe has been determined from the $\beta$ decay of ${}^{130}$I${}^{m}$, ${}^{130}$I${}^{g}$, and ${}^{130}$Cs. The $\gamma$ rays emitted in the decay of these species have been observed with high-resolution Ge(Li) detectors and Ge(Li) -Ge(Li) $\gamma$-$\gamma$ coincidence experiments have been performed. Decay schemes for these three isotopes have been deduced. The half-life of ${}^{130}$I${}^{g}$ has been measured as 12.36 ± 0.01 h. (auth)

## Nuclear Properties and Reactions, $150 \leq A \leq 189$

*Refer also to abstracts 1341, 1371, 1668, 1713, 1716, and 1774.*

**1696** (LYCEN-7344) LIFETIMES AND STRUCTURES OF SOME LEVELS ABOVE 1.5 MeV IN ${}^{168}$Yb, ${}^{164}$Er, AND ${}^{158\ 160\ 162}$Dy. Charvet, A.; Chery, R.; Duffait, R.; Morgue, M.; Sau, J. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Jul 1973. 13p. Dep. NTIS (U. S. Sales Only) $3.00.

The following lifetime measurements were performed in ${}^{168}$Yb: 62ns ($7^{-}$, 2222.5 keV); 0.34ns ($6^{-}$, 2111.1 keV) 81.7ns ($5^{-}$, 1998.7 keV); <=0.14ns ($4^{+}$, 2203.8 keV); in ${}^{164}$Er: 23.3ns ($7^{-}$, 1985.0 keV); 0.22ns ($6^{-}$, 1744.4 keV); <=0.08ns ($5^{-}$, 1664.2 keV); in ${}^{158}$Dy: <=0.11ns ($4^{+}$, 1895.3 keV); in ${}^{160}$Dy: 0.18ns ($4^{+}$, 1694.0 keV); in ${}^{162}$Dy: 1.93ns ($5^{-}$, 1485.9 keV). The experimental reduced transition probabilities are discussed in the framework of current nuclear models. (FR)

**1697** DETERMINATION OF THE AXIAL AND NON-AXIAL DEFORMABILITY OF ROTATING HEAVY NUCLEI.

Karadjov, D.; Mikhailov, I. N.; Piperova, J. (Joint Inst. for Nuclear Research, Dubna, USSR). Phys. Lett., 46B: No. 2, 163-166(17 Sep 1973).

The consequences of a possible existence of nonaxial deformation in excited rotational states of heavy nuclei is considered. Some estimates are given to exemplify the influence of this effect on the quadrupole moment matrix elements as well as on their relation to the r.m. charge radii. (auth)

**1698** DECAY OF $^{160}$Eu. Morcos, N. A.; James, W. D.; Adams, D. E.; Kuroda, P. K. (Univ. of Arkansas, Fayetteville). J. Inorg. Nucl. Chem.; 33: No. 11, 3659-3668(Nov 1973).

Irradiation of enriched $^{160}$Gd with 14.7 MeV neutrons was found to produce a new radioactivity with an average half-life of 52.8 ± 10 sec, which was assigned to the decay of $^{160}$Eu. $\beta$- and $\gamma$-radiations were studied by means of a Ge(Li) spectrometer and scintillation detectors and coincidence relations were established. Fifteen gamma rays and two beta rays were incorporated in a tentative decay scheme. (auth)

**1699** $\beta$-DECAY OF $^{176}$Lu. Komura, K.; Sakamoto, K.; Tanaka, S. (Tokyo Univ.). Nucl. Phys.; A213: No. 2, 426-428 (1973).

Evidence was found for the presence of a (0.30 ± 0.03)% $\beta^-$ decay branch of $^{176}$Lu to an $8^+$ state in $^{176}$Hf. (auth)

**1700** (p,t) REACTIONS ON NUCLEI IN THE RARE EARTH REGION. Oothoudt, M. A.; Hintz, N. M. (Univ. of Minnesota, Minneapolis). Nucl. Phys.; A213: No. 2, 221-266(1973). (COO-1265-131).

The (p,t) reactions on isotopic targets of $^{178,180}$Hf and all the stable isotopes of Yb and on natural targets of Gd, Dy, Er, Hf, Ta, W, Os and Au were studied at a beam energy of 19 MeV with an average resolution of 12 keV. A split-pole magnetic spectrometer was used to measure (p,t) Q-values and absolute differential cross sections. On the basis of angular distribution shapes definite $0^+$ and tentative $2^+$ assignments were made. Rotational bands were identified assuming an $I(I + 1)$ spacing. The (p,t) reaction populates excited $0^+$ states strongly in $^{174}$Yb, $^{176}$Hf, $^{168}$Yb and several Gd, Dy and Er isotopes. The $^{174}$Yb and $^{176}$Hf $0^+$ states are discussed in terms of the pairing phase transition and in terms of Nilsson orbitals with unequal (p,t) reaction amplitudes. Members of gamma and octupole vibrational bands were observed in the even-N nuclei. The lowest L = 0 transfers to states in $^{169,171}$Yb were found to have less than 55% of the strength to ground states in adjacent even-N nuclei. A strong L = 0 transfer to a state at 1513 keV in $^{171}$Yb indicates the presence of a possible K = 0 core vibration coupled to the unpaired $^5/_2$[512] neutron. The natural targets have furnished information on trends in cross sections for members of ground bands, gamma bandheads, $3^-$ octupole states, and strongly excited $0^+$ states. (auth)

**1701** PARTICLE–PARTICLE AND PARTICLE–HOLE INTERACTIONS AND NONROTATIONAL COLLECTIVE NUCLEAR STATES. Hernandez, E. S. (Univ., Buenos Aires); Plastino, A. Nucl. Phys.; A211: No. 3, 589-599(1973).

The structure of the $\gamma$-vibrational band-heads in the rare earth region is examined in relation to the different types of interaction matrix element that appear within the framework of the quasi-particle random phase approximation. The systematic trends of the force coupling constants, the B(E2) transition rates, and the quasi-particle numbers in the correlated ground state of the nuclei are analyzed in particular situations in which the interaction between quasi-particles contains either particle–particle or particle–hole terms, or both. The effects of schematic and nonschematic model calculations are discussed. (7 figures, 1 table) (auth)

**1702** CONVERSION-ELECTRON–GAMMA AND GAMMA–GAMMA DIRECTIONAL ANGULAR CORRELATIONS IN $^{160}$Dy. Zawislak, F. C.; Rogers, J. D.; Meneses, E. A. (Univ. Federal do Rio Grande do Sul, Porto Alegre, Brazil). Nucl. Phys.; A211: No. 3, 581-588(1973).

Gamma–gamma and conversion-electron–gamma angular correlations in $^{160}$Dy have been measured for the 298 keV–966 keV and 298 keV–879 keV cascades. Particle parameters of the 966-keV E2 transition were determined to be $b_2(E2; e_K) = +1.23 \pm 0.08$ and $b_2(F2; e_{\Sigma L + \Sigma M}) = +1.27 \pm 0.23$. The multipole mixing ratio for the 298-keV radiation was determined to be $\delta(M2/E1) = +0.04 \pm 0.01$, and the value $\delta(E2/M1) = -13 \pm 2$ for the 879-keV was confirmed. The EO–E2 mixture parameter for the 879-keV transition was determined as $q_K = 0.03 \pm 0.09$, assuming penetration effects to be negligible. (auth)

**1703** g-FACTORS OF THE TWO MEMBERS OF THE $K^\pi = 2^-$ BAND IN $^{182}$W. Seo, T.; Hayashi, T. (Kyoto Univ.). Nucl. Phys.; A211: No. 3, 573-580(1973).

The $K^\pi = 2^-$ band in $^{182}$W has been investigated through the measurement of the g factors of the two members of this band. The PAC measurements were made on the $\gamma-\gamma$ cascades in the decay of $^{182}$Ta under an externally applied magnetic field. The $g_K$ and $g_R$ factors have been determined through precession measurements on the $2^-$ 1289-keV and $3^-$ 1374-keV levels as $g(22) = 0.86 \pm 0.11$, $g(32) = 0.67 \pm 0.10$, $g_K = 1.05 \pm 0.12$ and $g_R = 0.48 \pm 0.09$. The $g_K$ value is in agreement with an almost pure two-quasiparticle configuration of $pp\{[514]\uparrow - [402]\uparrow\}$ for this band. (auth)

**1704** ENERGY LEVEL STRUCTURE OF $^{154}$Sm FROM THE $(n,n'\gamma)$ REACTION. Elbakr, S. A.; Van Heerden, I. J.; Robertson, B. C.; McDonald, W. J.; Neilson, G. C.; Dawson, W. K. (Univ. of Alberta, Edmonton). Nucl. Phys.; A211: No. 3, 493-508(1973).

Gamma rays from levels in $^{154}$Sm between 921 and 1817 keV excitation were observed following neutron inelastic scattering at neutron energies ranging from 1.1 to 2.3 MeV. Level positions and decay mode information were obtained. Gamma-ray production cross sections were determined and then used to deduce neutron inelastic cross sections. The results were compared with the predictions of the compound nuclear statistical theory to establish level spins and parities. (11 figures, 1 table) (auth)

**1705** g FACTOR MEASUREMENTS OF HIGH-SPIN ($I^\pi \leq 10^+$) ROTATIONAL STATES. Kalish, R. (Department of Physics, Technion–Israel Institute of Technology, Haifa, Israel); Herskind, B.; Hagemann, G.B. Phys. Rev. C 8: No. 2, 757-760 (Aug 1973).

The ion implantation perturbed angular correlation (IMPAC) technique was used to measure the precession angles of the $4^+$, $6^+$, $8^+$, and $10^+$ rotational states of $^{158,160,162}$Dy nuclei recoil implanted into magnetized Gd (T = 77 °K). The Gd($\alpha$, 2n)Dy reaction ($E_\alpha$ = 27 MeV) on natural Gd was used to populate the levels studied. By comparing the precession results obtained from the ($\alpha$, 2n) experiments for the $4^+$ and $6^+$ states to those obtained from Coulomb excitation IMPAC measurements one can conclude the following: (i) g($^{158}$Dy) = 0.36 ± 0.06 for $I^\pi = 4^+, 6^+$, and $8^+$; (ii) no effect due to final feeding times into the g.s. rotational band can be observed; and (iii) the deduced g factors are constant for members of the g.s. bands of $^{158,160,162}$Dy up to $I^\pi \leq 8^+$ but a possible drop in g for the $10^+$ states may be indicated by the data. A reduction in the g factors is theoretically expected to accompany the "back bending" in the energy levels which was recently observed for high–spin rotational states in some deformed nuclei. (auth)

**1706** STUDY OF THE (p, t) REACTION ON THE EVEN GADOLINIUM NUCLEI. Fleming, D.G. (Department of Chemistry, University of British Columbia, Vancouver 8, British Columbia, Canada); Günther, C.; Hagemann, G.; Herskind, B.; Tjøm, P.O. Phys. Rev. C 8: No. 2, 806-818 (Aug 1973).

The (p, t) reaction has been studied at 18 MeV on all the stable even–even Gd targets. A strong population of both $0^+$ and $2^+$ excited states has been found; the $0^+$ ($\beta$ vibrations) in the deformed nuclei are all ≃ 15% of the ground–state cross sections. The shape transition at N = 88 is observed in the $^{154}$Gd(p, t)$^{152}$Gd reaction: Two excited $0^+$ states are strongly populated. In the deformed Gd nuclei, a distinction between K = 0 and K = 2 $2^+$ states can be made on the basis of the shapes of their angular distributions. The spectrum observed in the $^{152}$Gd(p, t)$^{150}$Gd reaction is characteristic of that expected on spherical nuclei, with a relatively strong population of an excited $0^+$ state. Distorted–wave Born–approximation calculations are highly successful in fitting the $0^+$ transitions but, generally, not the $2^+$ and higher spin states. (auth)

**1707** INVESTIGATION OF BRANCHING RATIOS BETWEEN ISOMERIC STATES OF $^{154}$Tb. Lau, J.C.F.; Hogan, J.J. (Department of Chemistry, McGill University, Montreal, Quebec, Canada). Phys. Rev. C 8: No. 2, 715-717 (Aug 1973).

Half–lives and branching ratios of the three isomeric states of $^{154}$Tb have been measured from irradiation of gadolinium with 45– and 65–MeV protons. The spin assignments $7^{a}$, $3^{a}$,, and $0^{a}$, previously suggested were confirmed as representing the $m_2$, $m_1$, and g states, respectively. The branching from the $m_2$ to $m_1$ isomers was found to be weak, approximately 1.8 ± 0.6%. Branching from the $m_1$ to g state was quite substantial, measured to be 21.8 ± 0.7%. (auth)

**1708** DECAY OF $^{178}$Yb AND THE ISOMERS OF $^{178}$Lu. Orth, C.J.; Daniels, W.R.; Hoffman, D.C.; Lawrence, F.O. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544). Phys. Rev. C 8: No. 2, 718-724 (Aug 1973).

The neutron–rich radionuclide $^{178}$Yb has been produced by the (t, p) reaction in the bombardment of enriched $^{176}$Yb with 12–MeV tritons. The products of the bombardment were radiochemically separated by an ion–exchange column procedure. The decay of 74 ± 3–min $^{178}$Yb includes a 42.4–keV $\gamma$ transition as well as 348.4– and 390.8–keV transitions which deexcite a 390.8–keV $^{178}$Lu level that is populated from $^{178}$Yb by a 0.25 ± 0.03–MeV $\beta$ transition. The total disintegration energy of $^{178}$Yb is therefore 0.64 ± 0.03 MeV. The 28.4 ± 0.2-min-$^{178}$Lu ground state, which is the sole daughter of $^{178}$Yb, decays strongly to the $0^+$ and $2^+$ members of the $^{178}$Hf ground-state band and also to $^{178}$Hf excited states at 1260.0, 1309.9, 1323.0, 1362.4, 1434.0, 1443.8, 1496.1, 1513.7, 1561.2, 1566.8, 1772.0, and 1818 keV. A 22.7 ± 0.4-min high-spin isomer of $^{178}$Lu was produced in the bombardments only via the (t, n) reaction. The isomer undergoes $\beta$ decay to 1147-(86%) and 1478-(14%) keV states in $^{178}$Hf. No isomeric transition in $^{178}$Lu was observed. (auth)

**1709** DECAY OF $^{187}$Pt: COMPARISON OF THE LEVELS OF $^{187}$Ir WITH THOSE OF HEAVIER ODD MASS IRIDIUM ISOTOPES. Sebille-Schueck, C. (Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse, Orsay, France); Finger, M.; Foucher, R.; Husson, J. P.; Jastrzebski, J.; Berg, V.; Malmskog, S. G.; Astner, G.; Erdal, B. R.; Patzelt, P.; Siffert, P. Nucl. Phys.; A212: No. 1, 45-77(1973).

The decay scheme of 2.35-h $^{187}$Pt was investigated using isotopically separated samples produced by the ISOLDE facility at CERN. A total of 20 excited levels in $^{187}$Ir was established. For many of these levels, spin, parity and absolute probabilities of depopulating transitions were determined. The results indicate that the $^{187}$Ir nucleus can be described in terms of a single-particle Nilsson model including Coriolis coupling between bands ($\frac{3}{2}$ + [402], $\frac{1}{2}$ + [400]). (13 figures, 7 tables) (auth)

## Nuclear Properties and Reactions, $190 \leq A \leq 219$

*Refer also to abstracts 1341, 1729, 1762, 1764, and 1766.*

**1710** (KFK-EXT-3/73-2) MEASUREMENT OF THE SHAPE OF THE FIRST-FORBIDDEN BETA DECAY SPECTRUM $^{209}$Pb → $^{209}$Bi WITH AN IRON-FREE MAGNETIC DOUBLE-LENS SPECTROMETER. Kobelt, M. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Reaktorphysik). Jun 1973. 61p. (In German). Dep. NTIS (U. S. Sales Only $5.25.

Thesis. Submitted to Karlsruhe Univ. (West Germany).

The comparison of the experimental data with the theoretical prediction for the transition $^{209}$Pb ($\frac{9}{2}^+$) → $^{209}$Bi ($\frac{9}{2}^-$) shows that the shell model provides suitable means to describe nuclei in the neighborhood of double magic closed shells. In particular it turned out, that not all single particle potentials applied up to now are compatible with the observed shape factor for this transition. If single particle potentials are employed which are consistent with the measured shape factor, then the relativistic matrix element $^{A}F^{0}_{000}$ appears to dominate all others. (auth)

**1711** EFFECT OF ANGULAR MOMENTUM ON CHARGED PARTICLE INDUCED FISSION AT MODERATE EXCITATION ENERGIES. Williams, R. M.; Kieburtz, R. D.; Neuzil, E. F. (Western Washington State Coll., Bellingham). J. Inorg. Nucl. Chem.; 35: No. 11, 3651-3658(Nov 1973).

A study has been made of the effect of varying the amount of angular momentum possessed by the projectile particle on the fission probability of some elements lighter than polonium. The same compound nucleus with approximately the same excitation energy (±0.5 MeV) was produced by nuclear reactions using different charged particles, thus depositing varying amounts of angular momentum in the compound nucleus. All analyses were done using standard radiochemical techniques. The helium ion-induced fission of $^{195}$Pt at an excitation energy of 32.7 MeV resulted in a total fission cross section of 2.2 $\mu$ barn, while the deuterium ion-induced fission of $^{197}$Au at the same excitation energy had a total fission cross section of 4.6 $\mu$ barn for the same compound nucleus, $^{199}$Hg*. The helium ion-induced fission of $^{207}$Pb at excitation energies of 33.5 and 25.6 MeV occurred with total fission cross sections of 3080 $\mu$ barns and 27.2 $\mu$ barns respectively. The deuterium ion-induced fission of $^{209}$Bi giving the same $^{211}$Po* compound nucleus at approximately the same average excitation energies had total fission cross sections of 330 and 4.0 $\mu$ barn respectively. In the first case, the fission reaction induced by the lighter projectile nucleus occurred with a larger total fission cross section, while in the second case, the fission reaction induced by the heavier projectile nucleus possessed the larger total fission cross section. These results indicate that the angular momentum of the impinging nucleus contributes to but is not the only factor which influences the total fission cross section at moderate excitation energies. (auth)

**1712** PREDICTION OF A NEW TYPE OF THRESHOLD EFFECTS. Brentano, P. v. (Univ., Cologne); Gyarmati, B.; Zimanyi, J. Phys. Lett., 46B: No. 2, 177-179(17 Sep 1973).

Threshold effects can be expected in the proton spectrum from (d, p) reactions at the neutron threshold. The investigation of the anomaly may contribute to knowledge about the very extended, puffy states, e.g. "negative energy resonances." (auth)

**1713** Z-DEPENDENCE OF THE ELASTIC SCATTERING OF $\gamma$ RAYS. Smend, F.; Schumacher, M.; Borchert, I. (Univ., Goettingen, Ger.). Nucl. Phys.; A213: No. 2, 309-316(1973).

The differential cross sections for elastic scattering of 662 keV and 279 keV $\gamma$-rays from Pb, Ta, Nd, Sn, Mo, and Zn were measured at angles ranging from 45 to 135°. The results are compared with theoretical predictions taking into account Rayleigh scattering and nuclear Thomson scattering. The theoretical Rayleigh amplitudes are based on second order perturbation theory according to Brown et al., and on form factors calculated from relativistic HFS wave functions. A semi-empirical method of correcting the form factors is developed, valid for energies between 150 and 750 keV and charge numbers up to $Z = 82$. The average difference between calculated and measured differential cross sections was found to be 6%. (auth)

**1714** ELECTROEXCITATION OF GIANT RESONANCES IN $^{208}$Pb. Nagao, M.; Torizuka, Y. (Laboratory of Nuclear Science, Tohoku University, Tomizawa, Sendai, Japan). Phys. Rev. Lett. 30: No. 21, 1068-1071 (21 May 1973).

The giant-resonance region in $^{208}$Pb was observed by inelastic electron scattering. We present evidence for the existences of a $2^+$ (or $0^+$) state at ≈22 MeV and a $3^-$ state at ≈19 MeV with giant-resonance character. The resonance states between 8.6 and 11.6 MeV are confirmed to be $2^+$ (or $0^+$) and the sum of their strengths exhausts about 50% of the E2 sum rule or 100% of E0. (auth)

**1715** EVIDENCE FOR RECOIL EFFECTS IN HEAVY-ION TRANSFER REACTIONS. Kovar, D.G.; Harvey, B.G.; Becchetti, F.D.; Mahoney, J.; Hendrie, D.L.; Homeyer, H.; von Oertzen, W.; Nagarajan, M.A. (Lawrence Berkeley Laboratory, University of California, Berkeley, California, 94720). Phys. Rev. Lett. 30: No. 21, 1075-1078 (21 May 1973).

Data are presented for single-proton transfer reactions induced by $^{12}$C and $^{16}$O ions on $^{208}$Pb at high bombarding energies. Analysis using a no-recoil distorted-wave Born approximation (DWBA) yields spectroscopic factors in marked disagreement with light-ion results. Analysis using DWBA theory including first-order recoil corrections indicates that the discrepancies are largely, if not entirely, the result of ignoring recoil effects. (auth)

**1716** SMALL-ANGLE ELASTIC SCATTERING OF 14.8-MeV NEUTRONS. Benenson, R. E.; Rimawi, K.; Sexton, E. H.; Center, B. (State Univ. of New York, Albany). Nucl. Phys.; A212: No. 1, 147-156(1973).

The 14.8-MeV neutron elastic scattering differential cross sections of U, Pb, Hg, Ta, Sn and Al have been measured for angles extending from 10° down to 1.8° and for U and Pb down to 0.35°. Nuclear cross sections extrapolated to 0° have been compared with the Wick limit. The U nuclear cross sections did not rise so sharply toward 0°, and were not in so serious disagreement with the spherical optical model, as in earlier measurements. The smallest-angle data verified the Schwinger prediction. (3 figures, 2 tables) (auth)

**1717** DETERMINATION OF THE NUCLEAR CHARGE DISTRIBUTION OF $^{208}$Pb FROM ELASTIC ELECTRON SCATTERING AND MUONIC X RAYS. Friar, J. L.; Negele, J. W. (Massachusetts Inst. of Tech., Cambridge). Nucl. Phys.; A212: No. 1, 93-137(1973).

An iterative procedure is presented for determining a static nuclear charge distribution from experimental electron scattering cross sections and muonic-atom x-ray transition energies. The errors and error correlations implied by the independent statistical errors in the experimental data are expressed in coordinate space, and kernels are derived which specify the linear constraints imposed on the charge density by the experimental data. Pseudo-experimental data for $^{208}$Pb, generated from a known charge distribution, are used to demonstrate the validity of the procedure. A detailed analysis of experimental data for $^{208}$Pb is presented, utilizing electron scattering data at five different energies and six muonic energy levels. The theoretical implications of this work concerning quantum density fluctuations and the possible existence of a central depression are discussed. (14 figures, 9 tables) (auth)

**1718** SOME OBSERVATIONS REGARDING SINGLE-PARTICLE POTENTIALS FOR $^{208}$Pb AND CALCULATIONS OF FORM FACTORS FOR SINGLE-NUCLEON TRANSFER REACTIONS. Schiffer, J.P. (Argonne National Laboratory, Argonne, Illinois 60439); Körner, H.J. Phys. Rev. C 8: No. 2, 841-845 (Aug 1973).

Details are given discussing the calculational ambiguities in deriving a neutron distribution from sub–Coulomb transfer–reaction data. This is done in the context of a recent experimental result on neutron pickup from $^{208}$Pb and the extraction of a neutron–excess radius from these data. (auth)

## Nuclear Properties and Reactions, A ≥ 220

*Refer also to abstracts 1634, 1716, 1762, 2090, and 2093.*

**1719** (AEC-tr-7472) CALORIMETRIC MEASUREMENT OF THE ENERGY RELEASED BY $^{235}$U FISSION PRODUCTS FOR COOLING TIMES BETWEEN 70 SEC AND 7 × $10^6$ SEC. Lott, M.; Lhiaubet, G.; Dufreche, F.; Devillers, C.; de Tourreil, R. (Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires). May 1973. Translation of Paper No. 28/73 Spe. 22p. Dep. NTIS $3.25.

The residual power due to 1 thermal fission of $^{235}$U for a cooling time between 70 s and 7 × $10^6$ s was determined by a number of calorimetric measurements, the overall precision of which was less than ±5%. The method gave the total beta plus gamma power delivered by the fission products, after fissioning, as a function of cooling time. After a description of the calorimeter and the analytical methods used, the errors are discussed and the experimental results are compared with theoretical predictions. This comparison shows that, with the data used, the deviation is less than 7% for long times, with the greatest deviation at short cooling times corresponding to short-lived fission products. Preliminary results indicate that it is the same for very long cooling times and for $^{239}$Pu. It is concluded that, among the data entering into the calculation of the residual power, the disintegration schemes are probably correct and, if large differences appear between the theoretical evaluation and measurement for other fissile nuclides, they should probably be attributed to fission yields. (6 figures, 2 tables) (RWR)

**1720** (EURFNR–1110) EVALUATION OF NEUTRON DATA FOR U-235 ABOVE THE RESOLVED RESONANCE REGION FOR KEDAK. Schatz, B. (Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Neutronenphysik und Reaktortechnik). Jun 1973. 108p. (KFK–1629; EANDC(E)–151 (U)). Dep. NTIS (U. S. Sales Only) $7.75.

Work performed under United States–Euratom Fast Reactor Exchange Program.

In this report an evaluation for the neutron nuclear data types of U-235 above the resolved resonance region up to 15 MeV is described. In particular, the following data types were evaluated: the fission cross section, the total cross section, the capture-to-fission ratio and the mean number of secondary neutrons per fission. But also some of the other data types changed due to their dependence upon the primarily evaluated types. The presently recommended nuclear data for U-235 are contained in version 3 of the KEDAK library, which will presumably be released in the second half of 1973. (15 figures, 4 tables, 117 references). (auth)

**1721** (FEI-366) YIELDS AND KINETIC ENERGY OF THE FRAGMENTS DURING SPONTANEOUS AND INDUCED FISSION OF PLUTONIUM-242. D'yachenko, N. P.; Kabenin, V. N.; Kolosov, N. P.; Kuz'minov, B. D.; Sergachev, A. I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1972. 16p. (In Russian). Dep. NTIS (U.S. Sales Only) $3.00.

Yields and kinetic energies of fragments from spontaneous fission of plutonium-242 and fission of plutonium-241 by thermal neutrons were measured. The difference of the mean kinetic energies for spontaneous and induced fission constituted 2.6 ± 0.3 MeV. The yields of the fragments differed substantially. (3 figures, 3 tables) (tr-auth)

**1722** (UCRL-51427) EVALUATED NEUTRON REACTION DATA FOR URANIUM 238. Howerton, R. J.; MacGregor, M. H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Mar 1973. Contract W-7405-eng-48. 22p. Dep. NTIS $4.00.

Methods used to obtain evaluated neutron interaction and photon production data for $^{238}$U are described. (auth)

**1723** (Y-DR-111) PROMPT NEUTRON DECAY IN PLUTONIUM METAL USING $^{252}$Cf AS A RANDOMLY PULSED NEUTRON SOURCE. Mihalczo, J. T. (Oak Ridge Y-12 Plant, Tenn. (USA)). Aug 1973. Contract W-7405-eng-26. 39p. Dep. NTIS $4.00.

In order to investigate the applicability of randomly pulsed neutron measurements with $^{252}$Cf for the determination of the prompt neutron decay in plutonium metal, a series of measurements was performed with plutonium-metal assemblies having masses varying from 2.2 to 16 kg and with spontaneous fissions from $^{240}$Pu varying from 4.5 × $10^4$ to 8.2 × $10^5$ fissions/s. These assemblies included spheres and parts of spheres of plutonium with $^{240}$Pu content of 4.5 or 20.1 at. %. Since the prompt-neutron decay was easily measured with a californium source of 3000 fissions/s, this technique can be used for subcriticality determination and for nondestructive assay of plutonium. Time-dependent transport theory with existing ENDF/B-III cross sections satisfactorily predicted the time behavior of prompt neutrons after the injection of neutrons into these assemblies. (23 figures, 1 table) (auth)

**1724** HALF-LIFE OF PLUTONIUM-241. Zeigler, R. K. (Los Alamos Scientific Lab., NM); Ferris, Y. J. Inorg. Nucl. Chem.; 35: No. 10, 3417–3418(Oct 1973).

Mass spectrometric analyses by six laboratories over a period of approximately 5½ yr have been made on a sample containing a significant amount of $^{241}$Pu. The half-life of $^{241}$Pu was found to be 14.89 ± 0.11 yr. (auth)

**1725** FISSION BARRIERS FOR Cm ISOTOPES: WHAT IS THE NATURE OF THE N = 152 SHELL. Back, B. B. (Los Alamos Scientific Lab., NM); Hansen, O.; Britt, H. C.; Garrett, J. D. Phys. Lett., 46B: No. 2, 183–185(17 Sep 1973).

Fission barrier heights are measured for a series of Cm isotopes. Results indicate that near N = 152 shell effects are important, not only for the equilibrium deformation but also at the first maximum of the fission barrier. (auth)

**1726** ACCURATE FISSION CROSS-SECTION OF $^{235}$U FROM 0.002 TO 0.15eV AND ITS REFERENCE VALUE AT 2200 m/s. Deruytter, A. J.; Spaepen, J.; Pelfer, P. (Commission of the European Communities, Geel, Belg.). J. Nucl. Energy; 27: No. 9, 645–676(Sep 1973).

A new precise measurement of the 2200 m/s fission cross section of $^{235}$U was performed with a slow chopper at the BR2 reactor (energy-range from 0.002 to 0.15 eV). Simultaneous recordings of pulse-height and time-of-flight spectra of successively compared $^{235}$UF$_4$-layers and "standard" elemental boron-layers were made. The detection of the $^{10}$B(n, α)$^7$Li- and $^{235}$U(n, f) reaction fragments is made with excellent pulse-height resolution in low geometry with a surface-barrier detector. The absolute $^{10}$B contents were determined from direct weighing in vacuum combined with careful chemical and isotopic analysis of witness foils. The relative $^{10}$B contents of the standard boron-foils were checked by their neutron induced reaction rates in the geometry of the fission experiment. The amount of uranium on the fissile foils is determined by precise low geometry α-counting making use of the most recent and accurate α half-life values. The fission foils were also checked by α- and fission fragment counting in the geometry of the experiment. The fission cross section was calculated in the energy-range from 0.002 to 0.15 eV and the absolute value deduced at 2200 m/s was 587.6 ± 2.6 barn. The value at 25 × $10^{-3}$ eV is 591.8 ± 2.7 barn. These fission cross-section values were used to calculate the Westcott-$g_f$-factor for a 20.44°C Maxwellian distribution with the result: $g_f = 0.9780 \pm 0.0010$. (auth)

**1727** TOTAL RESIDUAL POWER EMITTED BY THE THERMAL FISSION PRODUCTS OF $^{235}$U. Lott, M.; Lhiaubet, G.; Dufreche, F. (Cen, Fontenay-aux-Roses, France). J. Nucl. Energy; 27: No. 9, 597–605(Sep 1973). (In French).

New results are presented concerning the $\beta + \gamma$ residual power following the $^{235}$U thermal fission for cooling times going from 70 to 7 × $10^4$ sec. A brief description is given of the experimental technique and of the methods used to obtain the residual power from the measurements. The different sources of errors are examined. The residual power curves for three different irradiation times as well as a curve due to one fission (elementary fission curve) are given. These experimental results are compared with other values from β and γ measurements and from theoretical calculations based on fission products systematics. For the considered cooling times the discrepancies between the experimental results and the theoretical calculations are less than 12% for cooling times <700 sec and inside the experimental uncertainties for cooling times >700 sec. (auth)

**1728** PROMPT γ RAYS EMITTED IN THE THERMAL–NEUTRON INDUCED FISSION OF $^{233}$U AND $^{239}$Pu. Pleasonton, F. (Oak Ridge National Lab., TN). Nucl. Phys.; A213: No. 2, 413–425(1973).

The average number and average energy of γ-rays emitted within ≈ 5 nsec after fission were determined as functions of fragment mass and as functions of total kinetic energy. They were obtained from a four-parameter experiment that recorded, event-by-event, correlated of $\gamma$-rays and of fission-fragment pairs and the time, relative to fission, at which a $\gamma$-ray was detected. For $^{233}$U(n$_{th}$,f) the average total number and energy emitted per fission were found to be 6.31 ± 0.3 and 6.69 ± 0.3 MeV, respectively, giving an average photon energy of 1.06 ± 0.07 MeV. The results for $^{239}$Pu(n$_{th}$,f) given in the same order, are 6.88 ± 0.35, 6.73 ± 0.35 MeV, and 0.98 ± 0.07 MeV. (auth)

**1729** SMALL ANGLE SCATTERING OF 3-MeV POLARIZED NEUTRONS. Galloway, R. B.; Maayouf, R. M. A. (Univ. of Edinburgh). Nucl. Phys.; A212: No. 1, 182-188(1973).

Differential cross sections and asymmetries of 3-MeV polarized neutrons from the $^2$H(d, n)$^3$He reaction scattered through angles from 1.6° to 7.7° by U, Pb and Cu have been measured. They are in good agreement with the theory of small-angle scattering taking account of the interaction between the magnetic moment of the neutron and the Coulomb field of the scattering nucleus. No significant effect was found attributable to the polarizability of the neutron. The polarization of the D–D neutrons was deduced from the asymmetry in the scattering of the neutrons by $^4$He. (4 figures) (auth)

**1730** ENERGY LEVELS IN $^{237}$Pu AND $^{239}$Pu. Grotdal, T.; Loeset, L.; Nyboe, K.; Thorsteinsen, T. F. (Univ. of Bergen, Norway). Nucl. Phys.; A211: No. 3, 541-558(1973).

The energy levels of $^{237}$Pu have been studied by the (d, t) reaction and the energy levels of $^{239}$Pu, by the (d, p) and the (d,d′) reactions at deuteron bombarding energies of 12 and 13 MeV. The scattered particles were analyzed in a broad-range magnetic spectrograph at angles of observation of 90°, 120°, 125°, and 150°. In $^{237}$Pu a total of five, and in $^{239}$Pu four Nilsson orbitals have been identified which were previously unknown. A $K^\pi = \frac{1}{2}^-$ octupole band has been assigned in $^{239}$Pu by means of the (d, d′) reaction. (6 figures, 7 tables) (auth)

**1731** ALPHA DECAY OF $^{251}$Fm. Ahmad, I.; Milsted, J.; Sjoblom, R.K.; Lerner, J.; Fields, P.R. (Chemistry Division, Argonne National Laboratory, Argonne, Ilinois 60439). Phys. Rev. C 8: No. 2, 737-744 (Aug 1973).

The $\alpha$–decay scheme of $^{251}$Fm has been investigated by measuring the $\alpha$–particle, $\gamma$–ray, and conversion–electron spectra of mass–separated $^{251}$Fm samples. The $\alpha$ spectrum was measured with the Argonne double–focusing magnetic spectrometer and also with a semiconductor detector. 13 $\alpha$ groups were observed with energies and intensities 7.305 (1.5%), 7.251 (0.93%), 7.184 (0.29%), 7.106 (≈0.05%), 6.928 (1.8%), 6.885 (1.7%), 6.833 (87.0%), 6.782 (4.8%), 6.762 (0.38%), 6.720 (0.44%), 6.681 (0.07%), 6.638 (0.56%), and 6.579 (0.26%). The $\gamma$ rays associated with the $\alpha$ decay of $^{251}$Fm were identified in an $\alpha$–$\gamma$ coincidence experiment. The multipolarities of prominent transitions were deduced from an $\alpha$–$e^-$ coincidence experiment. The half–life of $^{251}$Fm was measured from the decay of $\gamma$ rays and found to be 5.30 ± 0.08 h. The $\alpha$ branching was determined from the measured (Es K x rays)/$\alpha$ ratio and was found to be 1.9 ± 0.2%. From these experiments four rotational bands in $^{247}$Cf were identified. The ground state and the levels at 383.2, 480.4, and 678.0 keV in $^{247}$Cf were given Nilsson–state assignments of $(7/2)^+[624\downarrow]$, $(5/2)^+[622\uparrow]$, $(9/2)^-[734\uparrow]$, and $(7/2)^-[743\uparrow]$, respectively. On the basis of the favored $\alpha$ transition the ground state of $^{251}$Fm has been assigned to the $(9/2)^-[734\uparrow]$ single–particle state. (auth)

**1732** $\gamma$ RAYS FOLLOWING NEUTRON CAPTURE IN $^{235}$U AND THE SPINS OF $^{235}$U RESONANCES. Graves, R.G.; Chrien, R.E.; Garber, D.I.; Cole, G.W.; Wasson, O.A. (Brookhaven National Laboratory, Upton, New York 11973). Phys. Rev. C 8: No. 2, 781-795 (Aug 1973).

Capture and fission $\gamma$ rays from epithermal neutron irradiation of $^{235}$U have been identified. The capture $\gamma$ rays were used to construct a level diagram for $^{236}$U and to determine the spins of the $^{235}$U resonances. Coincidence $\gamma$–ray spectra, taken with a large 4$\pi$ fission neutron detector and Ge(Li) crystal were used to identify prompt–fission $\gamma$ rays. This apparatus was also used to suppress the background of prompt–fission $\gamma$ rays in the resonance spectra and to increase the probability of seeing capture $\gamma$ rays. Energies of high–energy $\gamma$ rays identified as due to resonant neutron capture in $^{235}$U are 6396, 5588, 5546, 5487, 5417, and 5292 keV; these populate excited states in $^{236}$U at 149, 957, 999, 1058, 1128, and 1253 keV. Many of the 14 low–energy $\gamma$ rays identified as capture have been assigned as those representing transitions between these low–lying excited states. On the basis of observing the 5588–keV $\gamma$ ray, which populates a $2^+$ final state in $^{236}$U, the spin–parity of the 2.040–, 12.39–, 14.53–, and 32.05–eV resonances have been assigned as $3^-$. We assigned $4^-$ to resonances at 11.67 and 16.10 eV by placing a $5^+$ state at 1128 keV. From the work of Schermer et al. and our $3^-$ assignment for the 2.040–eV resonance, we conclude that the 0.290– and 1.14–eV resonances are $3^-$ and $4^-$, respectively. On the basis of level systematics in even uranium isotopes and our high- and low-energy capture $\gamma$ rays, we propose that the 1128-keV level in $^{236}$U is most likely the $5^+$ member of the $K^\pi$, $J^\pi = 2^+, 2^+$ $\gamma$- vibrational band.

**1733** CROSS SECTION AND RECOIL PROPERTIES OF COPPER ISOTOPES FROM URANIUM BOMBARDED WITH 12-GeV PROTONS. Chang, S.K.; Sugarman, N. (The Enrico Fermi Institute, The University of Chicago, Chicago, Illinois 60637). Phys. Rev. C 8: No. 2, 775-780 (Aug 1973).

Cross sections and thick–target recoil properties have been measured for $^{61}$Cu, $^{64}$Cu, and $^{67}$Cu from the interaction of $^{238}$U with 11.5-GeV protons. The kinetic energies are much smaller than expected from a conventional fission process, even for the neutron–rich $^{67}$Cu. It is proposed that these Cu nuclides are produced at proton energies above 3 GeV by the fission of low mass nuclei which are the residues of an intranuclear cascade process involving high deposition energy and the emission of fragments prior to fission both in the fast cascade and the evaporation stage. (auth)

## Nuclear Theory

*Refer also to abstracts 1142, 1143, 1152, 1475, 1477, and 1718.*

**1734** PHASE TRANSITIONS ($\pi$-CONDENSATION) IN NUCLEI AND NEUTRON STARS. Migdal, A. B. (Inst. for Theoretical Physics, Moscow). Phys. Lett.; 45B: No. 5, 448-450(20 Aug 1973).

It is shown that in nuclear matter at $Z = N$ for density $n < n_0$ ($n_0$ nuclear density) an electrically neutral condensate of $\pi^+$, $\pi^-$, $\pi^0$ mesons arises. The results of the calculations for the case of the neutron star ($Z \ll N$) are given. In this case there are two phase transitions: one corresponds to $\pi^0$ condensation, and the second, to the electrically neutral $\pi^+$,$\pi^-$ condensation. The $\pi^-$ condensate apparently does not appear even at very high densities. (auth)

**1735** FIELD THEORETIC DESCRIPTION OF ($\pi^+$,p) AND (p,$\pi^+$) REACTIONS IN NUCLEI. Wienke, B. R. (Univ. of California, Berkeley). Progr. Theor. Phys. (Kyoto); 49: No. 4, 1220-1232(Apr 1973).

A relativistic description of ($\pi^+$,p) and (p,$\pi^+$) reactions using perturbative field theory is presented and an amplitude corresponding to the lowest order Feynman graphs is obtained. Form factors for the scattering processes enter naturally through nucleon wave functions or they can be left arbitrary in the absence of concrete knowledge. The method is applied to ($\pi^+$,p) and (p,$\pi^+$) reactions in $^{12}$C, and predictions are compared with experiment. Treatment of initial- and final-state interactions is also indicated for the model. (auth)

**1736** NEUTRON ESCAPE FROM ISOBARIC ANALOG RESONANCES. Miller, G. A. (Carnegie-Mellon Univ., Pittsburgh). Nucl. Phys.; A212: No. 2, 287-292(1973).

Neutron escape from isobaric analog states formed in proton scattering experiments is studied. The corrections to the dominant process of Coulomb mixing through compound states given by direct and two-step mechanisms are examined. In particular, these corrections are shown to be negligible for neutron escape from the $d_{5/2}$ analog of $^{89}$Sr. (3 figures, 1 table) (auth)

**1737** SHELL-MODEL CALCULATION OF ALPHA-TRANSFER FORM FACTORS AND ALPHA-WIDTHS. Yazaki, K. (Tokyo Univ.). Progr. Theor. Phys. (Kyoto); 49: No. 4, 1205-1219(Apr 1973).

A method for calculating $\alpha$-transfer form factors and $\alpha$-widths with shell-model wave functions is presented and applied to the $\alpha$-pick-up and the $\alpha$-stripping on $^{16}$O leading to the so-called ground-state rotational bands of $^{12}$C and $^{20}$Ne, respectively. In the case of $^{20}$Ne, the DWBA analyses of ($^6$Li,d) reactions and the observed $\alpha$-widths seem to indicate that the shell model with (sd)$^4$ configuration does not sufficiently describe the $\alpha$-clusterization of this nucleus, and it is necessary to introduce an additional $\alpha$-like correlation due to the mixing of higher configurations. (auth)

**1738** INCOHERENT NUCLEAR PRODUCTION PROCESSES. Faeldt, G. (Univ. of Lund, Sweden). Nucl. Phys.; B62: 86-108 (1973).

Nuclear production processes are discussed within the Glauber multiple scattering theory. The incoherent production cross section is a sum of contributions from diagonal and nondiagonal matrix elements. It has always been assumed that the non-diagonal terms could be neglected. It is shown that this is not the case. As a result the conventional incoherent cross section is greatly reduced. Corrections due to correlations are also considered. (auth)

**1739** MODEL DESCRIPTION OF LONG-RANGE CORRELATIONS IN NUCLEI. Gollwitzer, F.; Hoesch, M.; Huber, M. G.; Knuepfer, W. (Univ., Erlangen, Ger.). (1973). vp. (In German).

From Spring meeting of the Deutsche Physikalische Gesellschaft. Part A, Nuclear Physics; Heidelberg, Germany (19 Feb 1973).

Starting from a detailed analysis of the effective residual interaction in momentum space, a model of separable residual interactions is proposed. In this model the (1-, 3-, 5-, $0^+$, $2^+$) states of several shell-model nuclei ($^{12}C$, $^{16}O$, $^{18}O$, $^{18}F$, $^{40}Ca$, $^{90}Zr$, $^{208}Pb$) are calculated. A comparison with experimental data shows that the separable residual interaction model can reproduce satisfactorily major low-energy properties of the nuclei (collective excitations). From a comparison with standard calculations the empirically observed equivalence of residual interactions with a different range (e.g. delta force, Yukawa force) can be understood. It follows that all these forces are effectively long-range with the nuclear radius as a determinative parameter. (5 figures) (auth)

**1740** LEKTSII PO TEORII YADRA. (Lectures on Nuclear Theory). Sitenko, A. G.; Tartakovskii, V. K. Moscow; Atomizdat (1972). 352p.

Five lectures on nuclear structure are presented. Different nuclear models and the relations between them are discussed in detail. Although the emphasis is on new theories of the nucleus, established results are also reviewed. Separate abstracts were prepared for each of the lectures. (56 figures, 16 tables, 107 references) (RWR)

*For abstracts of individual chapters see: 1741–1745.*

**1741** NUCLEAR FORCES. pp 5-82 of Lektsii po Teorii Yadra. Sitenko, A. G.; Tartakovskii, V. K. Moscow; Atomizdat (1972).

As an introduction the structure of the nucleus and the nature of the nucleons are considered. Nuclear interactions between nucleons are examined. The basic structure of the deuteron is then discussed. The scattering of slow neutrons by protons, of slow neutrons in molecular hydrogen, and of protons by protons is examined. Noncentral nuclear forces and exchange forces are considered. Isotopic spin and charge independence of nuclear interactions are discussed. The scattering of nucleons on nucleons at high energies is examined. Problems are given at the end of the chapter. (13 figures, 4 tables) (JSR)

**1742** NUCLEAR MATTER. pp 83-124 of Lektsii po Teorii Yadra. Sitenko, A. G.; Tartakovskii, V. K. Moscow; Atomizdat (1972).

In a discussion of the saturation of the nuclear interaction, the dimensions of the nucleus and the density distribution inside the nucleus are first considered. Nuclear binding energy is also considered. With respect to the gas model of the nucleus the saturation of the nuclear interaction and the independence of the motion of individual nucleons in the nucleus, the properties of the ideal Fermi gas, contraction of the nucleus under the influence of attractive force between the nucleons, and conditions of saturation in the case of exchange nuclear forces are examined. In the independent pair model the repulsion between nucleons at a small distance, the Bethe–Goldstein equation, the determination of nuclear density and nuclear binding energy, and the applicability of the independent-particle model are discussed. Problems are given at the end of the chapter. (12 figures) (JSR)

**1743** SHELL STRUCTURE OF THE NUCLEUS. pp 125-216 of Lektsii po Teorii Yadra. Sitenko, A. G.; Tartakovskii, V. I. Moscow; Atomizdat (1972).

The motion of nucleons in the self-consistent field of the nucleus is first discussed. Independent-particle states are then examined. The independent-particle shell model of the nucleus is considered. Wave functions of the multiparticle shells are given. A classification of the multiparticle states is discussed. Center-of-mass motion of the nucleus in the shell model is examined. Parentage coefficients are given. The energy spectra of the light nuclei are examined. Problems are given at the end of the chapter. (10 figures, 7 tables) (JSR)

**1744** ROTATION AND VIBRATIONS OF NUCLEI. pp 217-310 of Lektsii po Teorii Yadra. Sitenko, A. G.; Tartakovskii, V. I. Moscow; Atomizdat (1972).

The vibrations of the spherical nucleus is first considered. The rotation of the coordinate system is then discussed. The rotation of the deformed nucleus and the oscillation of its surface are examined. The rotation of the axially symmetric nucleus and of the nonaxial nucleus is discussed. The rotational–vibrational excitation of the nucleus is examined in conclusion. Problems are given at the end of the chapter. (20 figures, 5 tables) (JSR)

**1745** PAIRING CORRELATIONS IN NUCLEI. pp 311-338 of Lektsii po Teorii Yadra. Sitenko, A. G.; Tartakovskii, V. I. Moscow; Atomizdat (1972).

In a consideration of the superfluid state of the nucleus, the short-range pairing forces and the long-range multipole forces, the Hamiltonian of the superfluid model, the Bogolyubov canonical transformation, wave functions and energy spectra, and the model of the coherent pairing interaction are examined. Under the residual interaction and collective effects in the nucleus an examination is made of the invariant trace of the Hamiltonian with residual interaction, the random phase approximation, the method of approximate second quantization, and the collective states of the nucleus in the model with residual interactions. (1 figure) (JSR)

**1746** SPECTRA AND ANGULAR DISTRIBUTIONS OF PHOTOPROTONS FROM DECAY OF DIPOLE ISOBARIC-ANALOG STATES Tertychnyi, G. Ya.; Yadrovskii, E. L. (Physical-Energy Inst., Moscow). Yadern. Fiz.; 18: No. 1, 39–47(Jul 1973). (In Russian).

The shell model and the related method of reduced widths of the R-matrix theory of nuclear reactions are applied to analysis of spectra and angular distributions of photoprotons. The main point is a specific channel of the proton decay of an isobaric-analog state, resulting in "phonon" destructions of the type $\Phi_0^\dagger = \Sigma_j \sqrt{(2j+1)/2T}\,[j_n^{-1}j_p]^{0+}\Psi_0$ in the wave function components. Concrete calculations are carried out for the nuclei $^{64}Ni$, $^{114}Sn$, and $^{124}Sn$. The relation of the photoproton spectra and the angular distributions to those for the (p,p′) reactions at incident proton energies corresponding to excitations of isobaric-analog states in the compound system is discussed. (5 figures) (auth)

**1747** SYSTEMATIC FEATURES IN THE LOW FREQUENCY EXCITATION SPECTRA OF EVEN–EVEN NUCLEI NEAR THE CLOSED SHELL. Sakai, M. (Tokyo Univ.). Phys. Lett.; 46B: No. 2, 167-169(17 Sep 1973).

The trends and regularities in the low frequency excitation spectra of even-even nuclei were investigated. They may provide a strong challenge to a better understanding of these spectra and the low frequency nuclear excitation. (auth)

**1748** PRODUCT FORM FOR PROJECTION OPERATORS. Atalay, B.; Brink, D. M.; Mann, A. (Oxford Univ.). Phys. Lett.; 46B: No. 2, 145-146(17 Sep 1973).

In some cases the projection operator can be written as a product of simple factors. This form leads to a scheme for approximate projection. Angular momentum and number projection are discussed as possible examples. (auth)

**1749** TRANSLATION AND ROTATION INVARIANCE CONDITIONS IN DEFORMED NUCLEI. Birbrair, B. L. (Leningrad Nuclear Physics Inst.). Phys. Lett.; 46B: No. 2, 152-154(17 Sep 1973).

The invariance conditions for the shell-model Hamiltonian in deformed nuclei make it possible to obtain both the particle-hole interaction and nonspherical parts of the single-particle potential provided the spherical part of the potential is known. (auth)

**1750** POSSIBILITY TO DETECT THE SPATIAL PARITY VIOLATION IN NUCLEAR FISSION THROUGH THE TWO-HUMP BARRIER. Budnik, A. P.; Rabotnov, N. S. (Inst. of Physics and Power Engineering, Obninsk, USSR). Phys. Lett.; 46B: No. 2, 155-156(17 Sep 1973).

The dependence of the height of the fission barrier on the parity combined with the resonance effect due to the existence of quasilevels in the second well may make it possible to detect the spatial parity violation in the fission process. (auth)

**1751** NUCLEAR MASS FORMULA AND THE NILSSON'S DEFORMED NUCLEI. Hwang, J. L.; Wang, C. S. (National Taiwan Univ., Taipei). Chin. J. Phys. (Taiwan); 11: No. 1, 77-80(Apr 1973).

The surface and volume energy terms in the Bethe-Weiszäcker mass formula $E = a_v A + a_s A^{2/3}$ are determined by counting energies of the level sequence of Nilsson's deformed nucleus. If the depth of the potential well is chosen to be 46.5 MeV and the distortion parameter is taken from the experimental value of Stelson, $a_v$ and $a_s$ are then equal respectively to 15.7 MeV and 17.8 MeV, which reproduce exactly the correct values determined by Green. (auth)

**1752** LIGHT NUCLEI. Warburton, E. K. (Brookhaven National Lab., Upton, NY). Rev. Brasil. Fis.; 2: No. 1, 37-59 (Mar 1972).

From international symposium on nuclear structure; Sao Paulo, Brazil. (8 Nov 1972).

Nuclear structure, energy levels and other nuclear properties of light nuclei are studied through spectrographic data. Several theoretical models are used for comparative evaluation, all of them in good accordance. Special attention is given to the Doppler-shift line-shape method exhaustively used for spin and parity determinations. A Ge-Li detector in gamma-gamma correlation is used in the majority of experiments. (auth)

1753 FORMULATION OF STRIPPING THEORY AND THE REVERSIBILITY OF STRIPPING REACTIONS. Seglie, E. Amherst, MA; Univ. of Massachusetts (1973). 108p. University Microfilms Order No. 73-22,815.

Thesis (Ph. D.).

A clarification of the stripping process is sought stressing the relation of an intuitive understanding to the formal theory. A time dependent-diffraction model based on Huygens' principle is developed which clarifies use of the common procedure of imagining an adiabatic switching on and off of interactions at remote times. The distorted wave Born approximation appears as the first term. The distinction between the prior and post forms in both the Born approximation and the distorted wave Born approximation (DWBA) is then studied in a one-dimensional model which facilitates clarification of some of the underlying mechanism. One sees how important it is that the potentials modify the wave functions in such a way that averages of different perturbing potentials over different regions still can be equal. The prior form DWBA has as a perturbation the intuitively appealing interaction responsible for the classical breakup of the deuteron, and this is used to clarify the "surface reaction" nature of stripping. (auth)

1754 INHOMOGENEITY OF NUCLEON DISTRIBUTIONS IN HEAVY NUCLEI. Antonchenko, V. Ya.; Simenog, I. V. (Inst. of Theoretical Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 8, 1358-1367(Aug 1973). (In Russian).

Equations are studied for a self-consistent nucleon field in nuclei with a large number of particles. An iterative solution scheme is proposed for nonlinear equations and the neutron and proton density distributions are obtained for some variants of pair nucleon–nucleon potentials. The resulting inhomogeneity of nucleon distribution over the nucleus volume is shown to depend on the choice of pair interaction. (auth)

1755 ELECTRON ANGULAR DISTRIBUTIONS FROM INELASTIC SCATTERING BY LIGHT NUCLEI. Tartakovskii, V. K.; Fursaev, A. V. (Kiev State Univ.,). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 8, 1331-1337(Aug 1973). (In Russian).

General expressions are obtained for summed inelastic electron form factors of nuclei with zero values for spin and isotopic spin in the 1p-shell. The nuclei are described by the independent particle model with intermediate coupling. The effect of magnetic scattering of electrons and that of the coupling scheme choice are discussed. The calculated electron angular distribution in inelastic scattering by $^{12}$C nuclei for various initial energy is compared with the experimental data. (auth)

1756 PHENOMENOLOGICAL WOODS–SAXON POTENTIAL FOR P-SHELL NUCLEI. Gamba, S.; Ricco, G.; Rottigni, G. (Univ., Genoa). Nucl. Phys.; A213: No. 2, 383-396(1973).

The parameters of a Woods–Saxon potential well were determined for ten p-shell nuclei by fitting the electron scattering form factors and single-particle binding energies. The resulting radius shows, for all but very light nuclei, a regular $A^{1/3}$ dependence while the depth smoothly decreases with the increasing proton energy. The observed energy dependence may be ascribed to the nonlocality of the HF potential. An energy-independent nonlocal potential, compatible with elastic electron and proton scattering, is proposed in the energy range −50 to + 50 MeV. (auth)

1757 THEORY OF OPTICAL POTENTIAL OF COMPLEX PARTICLES. Akhiezer, A. I.; Berezhnoi, Yu. A. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 8, 1278-1286(Aug 1973). (In Russian).

Optical potentials of elastic scattering of deuterons, tritons, $^3$He nuclei and $\alpha$-particles by nuclei are constructed in the high energy range on the basis of a multiple scattering model. The influence of the "eclipse" effects, finiteness of the complex particles' size and nucleon–nucleon correlations in the nuclei was studied as applied to the optical potentials, and the values of the corresponding corrections are estimated. (auth)

1758 PION-NUCLEUS SCATTERING IN AN ISOBAR-DOORWAY MODEL. Kisslinger, L.S.; Wang, W.L. (Department of Physics, Carnegie-Mellon University, Pittsburgh, Pennsylvania, 15213). Phys. Rev. Lett. 30: No. 21, 1071-1075 (21 May 1973).

Elastic pion-nucleus scattering is treated using a separation in Hilbert space via a projection-operator formalism. The basic assumption is that the elastic scattering and reactions due to the $\pi$–N resonance proceed through doorway states consisting of a $\Delta(1236)$ resonance in the nucleus. Nonresonant scattering and absorption processes are included by background terms, which are approximately known. The formalism is applied to $\pi^-$–$^{12}$C scattering. (auth)

1759 ANGULAR MOMENTUM DISTRIBUTION OF THE DEFORMED INTRINSIC NUCLEAR STATE. Bhaduri, R. K. (McMaster Univ., Hamilton, Ont.); Das Gupta, S. Nucl. Phys.; A212: No. 1, 18-26(1973).

In a Hartree–Fock or Hartree–Fock–Bogolyubov calculation of a deformed intrinsic state, one obtains a distribution of angular momentum states. Using an analogy from statistical mechanics, we obtain an expression for this distribution. The concept of an average temperature for the intrinsic state is introduced, which is directly related to the rotational energy content of the intrinsic state. The relationship of this temperature to microscopic particle–hole calculations is clarified. Assuming a rotational spectrum for the ground-state band of an axially symmetric doubly even nucleus, it is demonstrated that the deduced distribution of the angular momentum states gives rise to an overlap function of the intrinsic wave function which falls off, for small angles of rotation, as a Gaussian. Finally, the Yoccoz formula for the moment of inertia is derived using classical statistical mechanics, and semiclassical corrections to it are obtained. (1 table) (auth)

1760 PROJECTED HARTREE–FOCK (PROJECTION BEFORE VARIATION) METHOD. Vojtik, J. (Inst. of Physical Chemistry and Electrochemistry, Prague). Nucl. Phys.; A212: No. 1, 138-146(1973).

A study is made of the projected Hartree–Fock method for nuclei, formulated on the basis of the appropriate Brillouin condition. Several versions of the method are considered in connection with its use to approximate exact eigenstates of internal Hamiltonians of usual symmetry. The versions differ by what good quantum numbers are covered by the projection operator. The stability conditions are derived and used to study the nature of the solutions with consistent symmetry restrictions on the individual orbitals. Solutions of this type are shown to be unstable provided the projection includes the relevant symmetry. This result is used to compare some versions of the method and to show the superiority of the version based on the projection operator covering all symmetries. Some computational aspects of the application of the method are discussed. (auth)

1761 EQUIVALENT NEUTRON OPTICAL POTENTIALS IN THE SEPARABLE ENERGY-DEPENDENT APPROXIMATION. Bhatia, R. P.; Walker, J. F. (Univ. of Massachusetts, Amherst). Nucl. Phys.; A212: No. 1, 214-220(1973).

The single-term separable energy-dependent approximation for the two-body t-matrix is extended to the case of nonhermitian potentials. The formalism is applied to construct a separable potential for neutron scattering at low energies. Comparison with the exact scattering data gives good agreement. (2 figures, 2 tables) (auth)

1762 DAMPING OF THE GIANT RESONANCES IN HEAVY AND MEDIUM-HEAVY NUCLEI. Mshelia, E. D.; Roos, K.; Greiner, W. (Univ., Frankfurt am Main). Nucl. Phys.; A212: No. 1, 157-181(1973).

The damping of the giant resonances in heavy and medium-heavy nuclei can be described by thermalization and cooling-off processes. The direct emission of particles, which is strongly inhibited by Coulomb and centrifugal barriers, is neglected here. In the damping process, which begins with the thermalization, the 1p–1p giant resonance states induced by the incoming electromagnetic field are scattered inelastically due to the presence of two-body residual forces into other 1p–1h and 2p–2h states. In heavy nuclei there exist, at the energy of the giant resonance, several hundreds of such 2p–2h states. The 1p–1h dipole and quadrupole basis states for the diagonalization of the Hamiltonian are obtained from a spherical Nilsson potential. The density of the 2p–2h states obtained from the same potential are then used to determine the energy dependence of the widths of the giant resonances. (14 figures, 6 tables) (auth)

1763 SELF-CONSISTENT RADIAL DENSITY AND ELECTRON SCATTERING. Boffi, S. (Istituto di Fisica Teorica dell'Università, Pavia, Italy); Molinari, A. Phys. Rev. C 8: No. 2, 504-506 (Aug 1973).

Some constraints for the radial density are proposed involving a sum rule for the charge form factor and the right position of the diffraction dips appearing in the elastic electron scattering from nuclei. (auth)

1764 NUCLEAR EFFECTS IN THE PRODUCTION OF $\pi^+$ AND $\pi^-$ BY PROTONS ON NUCLEI. Silbar, R.R. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544); Sternheim, M.M. Phys. Rev. C 8: No. 2, 492-503 (Aug 1973).

We have modified an earlier semiclassical model of pion production by protons on nuclei by including various nuclear physics corrections. In addition to allowing for pn charge exchange and realistic nuclear densities, we have corrected the two-body input cross sections for the effects of the Pauli principle, Fermi motion, and nuclear optical potentials. The agreement with experiment is similar to that obtained earlier. Ambiguities arising from the nuclear corrections are found to be larger than the effects of moderate variations of the nuclear surface parameters. (auth)

**1765** MULTI-INTERACTION, FINITE-RANGE, TWO-MODE, DWBA ANALYSES OF DIRECT NUCLEAR REACTIONS. Edwards, S.; Robson, D.; Talley, T.L.; Thompson, W.J.; Werby, M.F. (Department of Physics, The Florida State University, Tallahassee, Florida 32306). Phys. Rev. C 8: No. 2, 456-471 (Aug 1973).

The finite-range distorted-wave Born approximation (DWBA) theory of direct nuclear reactions is modified to facilitate inclusion of both direct and exchange modes of transfer reactions and all effective interaction potentials for single-cluster transfers. While spin-orbit terms are neglected many other of the usual approximations are not made. Application of the formalism using the computer code FANLU2 is demonstrated in several examples designed to demonstrate useful features of such analyses. Contributions from all reaction mechanisms and both modes are shown to be necessary for an adequate description of the reaction $d(\alpha,t)^3He$ at 82 MeV with no parameter adjustment. The reaction $^9Be(p,\alpha)^6Li$ at 6 MeV illustrates angular momentum dependence of the reduced widths in a more complex reaction. Finite-range effects are demonstrated in a simplified analysis of the $^6Li(^3He,p)^8Be$ reaction at 17 MeV. Various aspects of such analyses with the code FANLU2 are discussed. (auth)

**1766** EXACT MACROSCOPIC CHARGE-INDEPENDENT ANALYSIS OF QUASIELASTIC (p,n) REACTIONS. Hoffmann, G.W. (Center for Nuclear Studies, University of Texas, Austin, Texas 78712). Phys. Rev. C 8: No. 2, 761-766 (Aug 1973).

A technique is described in which a strictly charge-independent optical potential for nucleons is derived from empirical neutron and proton potentials which provide optimum fits to the available data. Predictions for the (p, n) charge-exchange reaction on $^{208}Pb$ and $^{209}Bi$ are made by solving the coupled Lane equations exactly. It is found that both angular-distribution and excitation-function data are fitted quite well, without adjustable parameters. (auth)

**1767** CENTER-OF-MASS MOTION AND ANGULAR MOMENTUM PROJECTION. Ernst, D.J.; Shakin, C.M.; Thaler, R.M (Physics Department, Case Western Reserve University, Cleveland, Ohio 44106). Phys. Rev. C 8: No. 2, 440-443 (Aug 1973).

The results of calculations of rotational energies contain unphysical contributions from the rotation of the center-of-mass part of the wave function. A simple method is presented to remove those unphysical contributions in the case of projected Hartree-Fock calculations. Corrections to several existing Hartree-Fock calculations are computed. (auth)

**1768** EVALUATION OF THE NUCLEAR CHARGE FORM FACTOR WITH INTRINSIC HYPERSPHERICAL-COORDINATE WAVE FUNCTIONS. Palumbo, F. (Laboratorio di Fisica Nucleare Applicata, Comitato Nazionale per l'Energia Nucleare. Centro Studi Nucleari della Casaccia, Rome, Italy). Phys. Rev. C 8: No. 2, 511-513 (Aug 1973).

Evaluation of the nuclear charge form factor requires the evaluation of a many-body matrix element. In this paper it is shown how this many-body matrix element can be reduced to an integral over single-particle matrix elements when hyperspherical coordinates are used. (auth)

**1769** TRUNCATION OF CONFIGURATION SPACE AND THE NATURE OF EFFECTIVE TWO-BODY INTERACTION. Gupta, R.K. (Department of Physics, Panjab University, Chandigarh, India). Phys. Rev. C 8: No. 2, 472-479 (Aug 1973).

Using the renormalized G matrix (the $G_r$) results of Kuo (for the d-s shell) and of Kuo and Brown (for the f-p shell), a re-renormalized effective G matrix (the $G_{eff}$) for only two active orbits is calculated numerically, which would be valid for use in $(d_{5/2}s_{1/2})^n$ and $(f_{7/2}p_{3/2})^n$ configurations. The operators $G_r$ and $G_{eff}$ as well as the bare G matrix (the $G_b$) of Kuo and Brown, which thus define the transformation chain $G_b \rightarrow G_r \rightarrow G_{eff}$, are then analyzed in the light of truncation of the shell-model space. The analysis shows that the effect of this truncation can largely be taken into account by the addition of a pairing-force term to the effective two-body interaction. The relative change in $T = 1$ and $T = 0$ parts of the interaction due to the truncation of configuration space in various ways is also discussed. Finally, a comparison between the available empirically fitted effective interactions and our theoretical $G_{eff}$ interaction is carried out. (auth)

**1770** ENERGY FLUCTUATIONS IN THE NILSSON MODEL. Bassichis, W.H. (Department of Physics and Cyclotron Institute, Texas A&M University, College Station, Texas 77843); Tuerpe, D.R. Phys. Rev. C 8: No. 2, 541-544 (Aug 1973).

A Nilsson-like calculation of single-particle energies is carried out in a manner so that their sum may be exactly related to the total energy. The proposal of Strutinsky that the fluctuations in the energy are contained mainly in this sum, is shown to be quantitatively inaccurate. This is achieved by an explicit calculation of the fluctuations of other terms in the energy. (auth)

**1771** SPIN-SPIN TERM OF THE NUCLEON-NUCLEUS OPTICAL POTENTIAL. Hussein, A.H.; Sherif, H.S. (Nuclear Research Centre, Department of Physics, University of Alberta, Edmonton, Alberta, Canada). Phys. Rev. C 8: No. 2, 518-524 (Aug 1973).

For nucleons scattered by odd-mass nuclei, a spin-spin interaction consisting of spherical and tensor terms is added to the optical potential. The effect of this interaction on the scattering amplitude is calculated using distorted-wave Born approximation. The shape and strength of the spherical term are based on an approximate microscopic treatment, while the tensor term is treated phenomenologically. Theoretical calculations are carried out for several observable quantities. The calculated depolarizations are compared with the limited data available for 50- and 20-MeV protons. Because of large uncertainties in the 50-MeV data it is not possible to clearly assess the role played by each of the spin-spin terms. However, for the 20-MeV data, the depolarizations calculated using the spherical term alone are found to be consistently different from the measured values. These suggest that contributions from the tensor term are important. The effects of the spin-spin interaction on the differential cross section, polarization, asymmetry, and rotation parameters are found to be small. It is shown that measurements of the angular distribution of the depolarization parameter could be useful in determining the strength of the tensor interaction. (auth)

**1772** INTERPRETATION OF VOLUME CONSERVATION IN THE NILSSON MODEL. Bassichis, W.H. (Cyclotron Institute and Department of Physics, Texas A&M University, College Station, Texas 77843). Phys. Rev. C 8: No. 2, 480-482 (Aug 1973).

The condition of constant volume for the deformed potential of the Nilsson model is shown to follow from the relationship of the model to constrained Hartree Fock. Essential to the demonstration are two assumptions, one relating the deformation and rms radius in the Nilsson model and the second concerning the separation of the Nilsson potential into an internal and external part. This analysis yields insight into the various schemes for obtaining the energy from the Nilsson eigenvalues. (auth)

**1773** ORIGIN OF j AND Q DEPENDENCE IN HEAVY-ION TRANSFER REACTIONS. Pougheon, F.; Roussel, P. (Institut de Physique Nucléaire, Université Paris Sud, 91406 Orsay, France). Phys. Rev. Lett. 30: No. 24, 1223-1227 (11 June 1973).

A semiclassical treatment of heavy-ion-induced reactions is used to analyze experimental results on the ($^{16}O$, $^{15}N$) and ($^{14}N$, $^{13}C$) reactions at 80 MeV and the ($^{12}C$, $^{11}B$) reactions at 95 MeV, on a $^{54}Fe$ target. It is shown that kinematical conditions and angular momentum coupling are sufficient to explain the strong j effect and Q dependence observed in the selective population of the various states. (auth)

**1774** CONSTRAINED-HARTREE-BOGOLYUBOV TREATMENT OF THE PAIRING-PLUS-QUADRUPOLE MODEL: DISCONTINUITIES IN NUCLEAR MOMENTS AT HIGH SPINS. Kumar, K. (Department of Physics, Vanderbilt University, Nashville, Tennessee, 37203). Phys. Rev. Lett. 30: No. 24, 1227-1230 (11 June 1973).

I discuss a self-consistent, microscopic theory of nuclear rotations at high spins and review results obtained previously for the spin dependence of the moment of inertia, deformation, and energy gaps of $^{160}Dy$. Additional results given here suggest some striking discontinuities in isomer shifts, gyromagnetic ratios, and B(E2) values at high spins. Theoretical results are consistent with the recent measurements of gyromagnetic ratios and B(E2) values, but a greater precision is needed to test the predicted discontinuities. (auth)

**1775** DENSITY MATRIX APPROACH TO THE INGLIS CRANKING MODEL. Reorientation Effect, Excited Bands, Transitions Within the Ground-State Band and the Yrast Line, Nuclear Moments of Inertia. Birbrair, B. L. (Leningrad Nuclear Physics Inst.). Nucl. Phys.; A212: No. 1, 27-44(1973).

It is shown that the Inglis cranking model can provide a rather detailed description of ground-state bands and yrast lines of deformed doubly even nuclei. Relations describing ground and excited states for a given angular momentum value and transitions within the ground-state band and the yrast line are obtained using field-theoretical methods of a quantum many-body theory. (7 figures, 1 table) (auth)

# PHYSICS (PLASMA AND THERMONUCLEAR)

**1776** HEAT TRANSFER TO A HEMISPHERICAL BODY IN A SUPERSONIC ARGON PLASMA. Nowak, R. J. (Langley Research Center, Hampton, VA); Yuen, M. C. AIAA (Amer. Inst. Aeronaut. Astronaut.). J.; 11: No. 11, 1463-1464(Nov 1973).

Heat transfer was measured for conducting (copper) and nonconducting (teflon) models in a Mach 4.6 low-density Ar plasma in the absence and presence of magnetic fields up to 0.5 Telsa. Results show the importance of local wall currents both with and without magnetic field. For the conducting model, an electron flux entering the surface increased the stagnation-region heat flux compared to the nonconducting model. For the nonconducting model, theory predicts well the heat transfer for zero field but fails to predict the slight increase at the stagnation region with high magnetic field. (DLC)

**1777** TECHNOLOGY INDEX FOR PLASMAPHYSICS RESEARCH AND FUSION REACTORS. Volume 7, No. 8, 1973. Bibliography, Author Index, Subject Index, Appendix. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1973). 41p.

The listing includes 179 references. (MCW)

**1778** PLASMA PHYSICS INDEX. Volume 8, No. 9, 1973. Bibliography, Author Index, Subject Index. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1973). 209p.

This listing includes 518 references. (MCW)

*For abstracts of individual papers see: 1780–1795, 1868, 1869, and 1870.*

**1779** PLAZMENNYE USKORITELI. (Plasma Accelerators). Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). 312p.

Papers concerning the physical processes in plasma accelerators are included, covering some specific accelerator types, magnetic plasma compressors, plasma diagnostics methods, and plasma accelerator applications in thermonuclear studies, gasdynamics, and space studies. The topics also include plasma acceleration control problems, high-vacuum technology, plasma accelerator designs with narrow and broad acceleration zones, and electrode processes in high-current accelerators. Separate abstracts or title lists are included here for 19 of the papers. (IAA)

**1780** PLASMA ACCELERATORS. Morozov, A. I. pp 5-15 of Plazmennye Uskoriteli. Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). (In Russian)

General principles on which plasma accelerators are based are discussed, covering the definition of plasma acceleration concept; various plasma acceleration techniques; various types of plasma conductivity; and representative plasma accelerator designs. Development of a more efficient plasma acceleration technology is visualized in the future. (21 references) (IAA)

**1781** APPLICATION OF PLASMA ACCELERATORS IN GASDYNAMICS. Grodzovskii, G. L. pp 25-40 of Plazmennye Uskoriteli. Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). (In Russian)

A review is given of Soviet work on the uses of plasma acceleration in high-velocity wind tunnels and ion propulsion systems. The topics include various wind-tunnel plasma accelerator designs; electric-arc gas plasma heating systems; wind tunnels with electric arc heating and an MHD channel; heat transfer in bodies inserted in wind tunnels; electromagnetic shock tubes; and simulators of motion in the ionosphere. Also discussed are the Yantar automatic laboratory for ionosphere studies and a plasma-ion propulsion system operating in the ionosphere. (IAA)

**1782** ACCELERATORS WITH A CLOSED HALL CURRENT. Grishin, S. D.; Erofeev, V. S.; Zharinov, A. V. pp 54-61 of Plazmennye Uskoriteli. Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). (In Russian)

The theoretical basis of the Hall current accelerator is discussed in the light of Soviet and non-Soviet work of the last decade. Experimental investigations in this field are believed to confirm the theoretical possibility of ion accelerators with a closed Hall current. Ion accelerators of this type are recommended as a new effective technique for various physical and technological applications requiring ion acceleration. (IAA)

**1783** STUDY OF PLASMA SYSTEMS WITH A CLOSED ELECTRON DRIFT AND A DISTRIBUTED ELECTRIC FIELD. Esipchuk, Yu. V. pp 75-84 of Plazmennye Uskoriteli. Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). (In Russian)

Theoretical considerations are given to provide a basis for the creation of plasma accelerators with a distributed electric field and confined electron drift. Such accelerators include optically focusing cold plasma systems with equipotential magnetic field lines, and electrostatic plasma traps with a plasma electric field used for heating and containment of ions in the trap. The optical systems of a single-lens and two-lens plasma accelerators with an extended acceleration zone and contained electron drift are discussed in detail. Block diagrams and optical system line-drawings of these plasma accelerators are included. (IAA)

**1784** GENERATION OF ENERGETIC ION FLUXES FROM A HIGH-TEMPERATURE ELECTRON DISCHARGE IN AN INHOMOGENEOUS MAGNETIC FIELD. Demirkhanov, R. A.; Kursanov, Yu. V.; Skripal, L. P.; Kharin, G. V. pp 99-104 of Plazmennye Uskoriteli. Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). (In Russian)

**1785** STATIONARY HIGH-CURRENT PLASMA ACCELERATORS. Porotnikov, A. A. pp 105-114 of Plazmennye Uskoriteli. Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). (In Russian)

Theoretical analysis of the performance characteristics of plasma accelerators with coaxial electrodes, high discharge currents at relatively low pressures, and an electromagnetic acceleration effect whose principal contributor is the interaction between the arc current and the intrinsic magnetic field of the system. Expressions are given to relate the power output, current, voltage, plasma ejection rate, mass rate, pulse, and efficiency of these accelerators. Equations describing the plasma dynamic behavior in the interelectrode space are also included. The performance of alkali metals, ammonia, and hydrogen as plasma sources is characterized as much superior to that of nitrogen, argon, and helium. Efficiency and pulse are shown to increase with increasing plasma flux velocity and discharge current in these accelerators. (IAA)

**1786** ANALYSIS AND INVESTIGATION OF CATHODE PROCESSES IN A HIGH-CURRENT ARC DISCHARGE. Dorodnov, A. M. pp 157-179 of Plazmennye Uskoriteli. Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). (In Russian)

The physical and performance characteristics of high-current arc discharges are discussed in discharge systems with cold cathodes, refractory cathodes with a spot, and thermionic refractory cathodes without a spot. The applicability of such cathodes in stationary plasma accelerators is assessed. The results of pertinent experiments with these cathodes at elevated and lowered pressures are discussed, indicating their inconclusiveness. Theories concerning the current transfer mechanism in a refractory thermionic cathode are reviewed. The effect of ion fields on electron emission from a thermionic cathode in an arc plasma is also discussed. (IAA)

**1787** PULSED PLASMA ACCELERATORS. Kalmykov, A. A.; Leskov, L. V.; Pergament, M. I. pp 183-191 of Plazmennye Uskoriteli. Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). (In Russian)

A description is given of experiments in which the performance of coaxial hydrogen plasma accelerators and that of erosion plasma accelerators were investigated in a vacuum, at capacitor-stored powers from 200 to 3600 J and discharge-current half-period lengths from 1.6 to 3.4 μs. The initial, middle, and final development phases of a discharge in these accelerators are analyzed in detail. A theoretical description of processes in them is included. Prospects for practical uses of these accelerators are projected. (IAA)

**1788** TWO-CASCADE PLASMA ACCELERATION. Azizov, E. A.; Komel'kov, V. S.; Stepanenko, M. M. pp 195-198 of Plazmennye Uskoriteli. Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). (In Russian)

A description is given of a plasma accelerator with a conical electrode-injector forming its first acceleration cascade, and two ring electrodes positioned at 25 and 55 cm from the end of the accelerator, forming its second acceleration cascade. Magnetic probes, photoscanning, and measurements of the voltage—current characteristics were conducted to study the dynamics of interactions between plasma jets and cascade currents. The adequate performance of these cascade-type plasma accelerators was proved by experiments. (IAA)

**1789** INVESTIGATION OF THE HIGH-FREQUENCY OSCILLATIONS IN THE FLOW OF A PULSED COAXIAL PLASMA ACCELERATOR: ONE MECHANISM OF INHOMOGENEITY. Rushailo, A. M. pp 203-207 of Plazmennye Uskoriteli. Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). (In Russian)

**1790** EFFECT OF NEAR-ELECTRODE PROCESSES ON PLASMA BEHAVIOR IN ELECTRODYNAMIC ACCELERATORS. Kvartskhava, I. F.; Reshetniak, N. G.; Khautiev, E. F. pp 207-211 of Plazmennye Uskoriteli. Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). (In Russian)

A review is given of a number of specific effects caused by near-electrode processes in unsteady high-current discharges used for electrodynamic acceleration of plasma. It is shown that all the experimentally observed effects, as well as the phenomenon of "anti-Ampere motion" of cathode spots, can be explained in terms of the interaction of electrode spot plasma jets with the magnetic field and the discharge plasma. It is shown that this interaction, depending on the electrode polarity, leads to effects of contradictory character: in the cathode region an attenuation of the accelerating action of the Ampere force occurs, while in the anode region the effect of this force is intensified. (IAA)

**1791** EXPERIMENTAL DETERMINATION OF THE VELOCITY CHARACTERISTICS OF A PULSED EROSION-TYPE ACCELERATOR. Gubarev, V. Ya.; Kozlov, N. P.; Leskov, L. V.; Protasov, Yu. S.; Khvesiuk, V. I. pp 211-214 of Plazmennye Uskoriteli. Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). (In Russian)

**1792** CALCULATION OF TWO-DIMENSIONAL UNSTEADY PLASMA FLOWS IN CHANNELS. Brushlinskii, K. V.; Morozov, M. E.; Prianishnikov, V. A.; Savichev, V. V. pp 251-254 of Plazmennye Uskoriteli. Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). (In Russian)

Results are reported of a numerical study of so-called compression flows of plasma in coaxial channels i.e., flows during which a strong compression of the plasma along the channel axis is observed. A two-dimensional (axisymmetric) plasma flow across an intrinsic azimuthal magnetic field in a channel formed by two electrodes is considered. The steady-flow regime is determined by the buildup method during the solution of the unsteady problem for a system of magnetogasdynamics equations. It is found that, in the presence of viscosity, it is possible to have flows that are not accompanied by compression along the axis, owing to the heating of the plasma near the electrodes due to friction. (auth)

**1793** APPLICATION OF A THOMSON MASS SPECTROGRAPH WITH AN ELECTRON-OPTICAL RECORDER TO THE INVESTIGATION OF THE MECHANISM OF PLASMOID ACCELERATION. Pergament, M. I.; Iaroslavskii, A. I. pp 268-271 of Plazmennye Uskoriteli. Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). (In Russian)

**1794** METHODS OF CORPUSCULAR PLASMA DIAGNOSTICS IN A PULSED COAXIAL ACCELERATOR. Kalmykov, A. A.; Timofeev, A. D.; Shevchuk, B. A. pp 278-281 of Plazmennye Uskoriteli. Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). (In Russian)

**1795** STABILITY OF PLASMA FLOWS IN MULTIPOLAR MAGNETIC FIELDS. Demidenko, I. I.; Lomino, N. S.; Padalka, V. G.; Repalov, N. S.; Tereshchenko, F. F. pp 282-301 of Plazmennye Uskoriteli. Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). (In Russian)

Consideration is given of a number of problems regarding the stability of plasma flows during the transport of the plasma by a multipolar field. A study is made of the development of an interchange instability of a plasma in quadrupole and octupole magnetic fields. It is shown that when the ion cyclotron radius and the transverse wavelength of the perturbation are comparable, so that the plasma cannot be considered within the framework of a conducting fluid model, the plasma stability boundary is determined by the location of the minimum length of the closed magnetic line of force and is located within the critical magnetic surface. A study of the energy spectra of the plasma density and electric field fluctuations showed that the characteristic frequency of the fluctuations increases with an increase in the field strength in the case of an octupole magnetic field and decreases as the probe moves toward the center of the magnetic system. (IAA)

# Confinement and Heating

*Refer also to abstracts 1886, 1887, 1895, 1928, and 1930.*

**1796** (GULF-GA-A-12512) CLASSICAL DIFFUSION DUE TO THERMAL EQUILIBRIUM FLUCTUATIONS IN THE DC OCTOPOLE. Tamano, T.; Prater, R.; Ohkawa, T. (Gulf General Atomic Co., San Diego, Calif. (USA)). 29 Jan 1973. Contract AT(04-3)-167. 11p. (CONF-730315-15). Dep. NTIS $3.00.

From third international symposium on toroidal plasma confinement; Garching, F. R. Germany (26 Mar 1973).

"Classical" diffusion due to thermal equilibrium fluctuations was experimentally observed in the dc octopole. Measurements of the magnitude and of the dependences of this diffusion coefficient on plasma parameters are presented. This diffusion can exceed classical diffusion due to binary electron—ion collisions when the plasma dielectric constant is small. This regime is investigated in the dc octopole. (auth)

**1797** (JINR-P4-6952) PLASMA HEATING BY ELECTROMAGNETIC (LASER) RADIATION. Getmanov, B. S.; Makhan'kov, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1973. 9p. (In Russian). Dep. NTIS (U. S. Sales Only) $3.00.

The problem is discussed for electromagnetic radiation scattering resulting from the $t \rightarrow t' + s$ decay at homogeneous plasma heating (t is electromagnetic, s is ion-acoustic waves). Because of strong anisotropy of s oscillations, induced by instabilities, the rate of scattering of t waves by these oscillations decreases considerably. (auth)

**1798** (ORNL-TM-4363) NEUTRAL-INJECTION HEATING OF TOKAMAKS. McNally, J. R. Jr. (Oak Ridge National Lab., Tenn. (USA)). Oct 1973. Contract W-7405-eng-26. 13p. Dep. NTIS $3.00.

The injection of energetic neutral hydrogen beams into a nearly fully ionized helium plasma in a tokamak is discussed. This allows good trapping efficiencies primarily because of a quasi-resonance charge exchange between $H^0$ and $He^{2+}$, while conversely the charge exchange losses of the warmed plasma are greatly reduced. The two problem areas are discussed: (1) the charge exchange cross section for $H^+$ on $He^+$ and (2) the effect of $Z = 2$, $A = 4$, or 3 ions on the ion convection and conduction in the helium plasma case. (MOW)

**1799** (RISO-290) ELECTRON HEATING IN A SINGLE-ENDED Q-MACHINE. Pecseli, H. L.; Petersen, P. I. (Danish Atomic Energy Commission, Risoe. Research Establishment). May 1973. 16p. Dep. NTIS (U. S. Sales Only) $3.00.

Electron heating in a single-ended Q-machine was tried out by two different techniques: (1) by application of $\mu$-wave power at the electron cyclotron frequency and (2) by insertion of a positively biased grid close to the hot plate. The electron temperature $T_e$ was measured with a Langmuir probe. By means of the first method, the electron temperature was increased by a factor of 2 without any significant disturbance of the ion distribution function. By the other method, $T_e$ was increased by a factor of 4. This heating was accompanied by a severe distortion of the ion distribution function which could be remedied by charge exchange cooling of the ions. (auth)

**1800** (UCID-16357) RETURN TO BRUTE FORCE. Hamilton, G. W.; Osher, J. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 26 Sep 1973. Contract W-7405-eng-48. 7p. Dep. NTIS $3.00.

It now appears feasible to attempt to overcome instability losses by the brute force approach. Calculations show that the number of trapped ions can be increased by an order of magnitude and that trapping by ground-state ionization will become important under brute force conditions, because of recent improvements in beam, vacuum, and magnet technology. The key assumption is that the time constant for losses due to instabilities is constant. (auth)

**1801** LAGRANGIAN DESCRIPTION OF PHASE SPACE FLOW: TURBULENT HEATING. Koch, P. (Paris Univ., Orsay, France). Phys. Fluids; 16: No. 5, 651-664(May 1973).

Anomalous electrostatic dissipation in a collisionless plasma is caused by an induced charge separation which, in the homogeneous case, is particularly large when high local concentrations of the two species occur close together. If a turbulent plasma state has evolved from an unstable initial state that is only slightly perturbed, particle bunching (with maximum number density proportional to $T_0^{-1/2}$ at low initial temperature $T_0$) takes place at points of overtaking—reversal of the ordering of particles with the same initial velocity. Overtaking is governed by a differential equation which involves the applied field only implicitly. Use of this equation in a simple case shows that a bunch of particles of one species causes bunching in the other species, and that the sense of the resulting turbulent electric field is such as to oppose the laminar motion. The characteristic time of formation of an ion bunch by an electron bunch of incremental number density $\Delta n$ is $(4\pi e^2\Delta n/m_i)^{-1/2}$. When the charge separation is expressed in terms of Lagrangian coordinates, a possible example of this phenomenon is revealed by the appearance of islands in the relevant curve. The islands represent adjacent bunches of electrons and ions, and preliminary investigation indicates that they might provide a major portion of the dissipation. A computer study to amplify these findings is proposed. (auth)

**1802** RECENT DEVELOPMENTS IN STRONG SHOCK WAVE RESEARCH. Gross, R. A. (Columbia Univ., New York). Contract AT(30-1)-3954. pp 91-99 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (15 Sep 1971). See CONF-710921–.

Shock speeds to 4 × $10^8$ cm/sec and a plasma temperature of $10^7$°K have been achieved in an electromagnetically driven shock tube. The characteristics of this device and some of the physical data obtained from experiments performed in it are described. (auth)

**1803** EXPERIMENTS ON PLASMA CONFINEMENT IN A MAGNETIC MULTIMIRROR TRAP. Budker, G. I.; Danilov, V. V.; Kruglyakov, E. P.; Ryutov, D. D.; Shun'ko, E. V. (Inst. of Nuclear Physics, Novosibirsk, USSR). Zh. Eksp. Teor. Fiz.; 65: No. 2, 562-574(Aug 1973). (In Russian).

The results of experiments carried out with the aim of verifying the efficiency of plasma confinement in a magnetic multimirror trap are presented. The experiments were performed with a low-temperature alkali plasma. The density distribution along the trap axis was investigated under stationary conditions. The results are in satisfactory agreement with the theory previously proposed. Decay of the plasma after switching off of its source was also investigated. It is found that in a multimirror trap the plasma half life is much higher than in a homogeneous field. (auth)

**1804** NEUTRAL-INJECTION PLASMA IN THE CULHAM LEVITRON. Freeman, R.; Riviere, A. C.; Sweetman, D. R. (United Kingdom Atomic Energy Authority, Abingdon, Eng.). (1973). vp.

From third international symposium on toroidal plasma confinement; Garching, Germany (26 Mar 1973).

The Levitron has a 30-cm major radius floating superconducting ring carrying up to 500 kA. Current supported with the aid of vertical field coils which are also used to determine the shape of the magnetic surfaces, and consequently the minimum-average-B properties. A beam of 5-keV neutral atoms was injected and trapped in a toroidal experiment. There appears to be no anomalous loss of these injected ions at least for times of 4 msec. The resulting cold plasma produced by their ionization of the gas has a lifetime of several hundred milliseconds which, provided no additional loss of plasma occurs, should be sufficient to allow exponentiation to higher densities where heating from the injected ions becomes significant. (GE)

**1805** HIGH-POWER HIGH-EFFICIENCY ION SOURCE. Aldcroft, D.; Burcham, J.; Cole, H. C.; Cowlin, M.; Sheffield, J.; Speth, E. (United Kingdom Atomic Energy Authority, Abingdon, Eng.). (1973). vp.

From third international symposium on toroidal plasma confinement; Garching, Germany (26 Mar 1973).

The results of initial tests of the injection system on the CLEO Tokamak are described. The injector utilizes a new design of plasma source, and beam powers of up to 250 kW (65% $H_1^+$, 20% $H_2^+$, 15% $H_3^+$) 8.5 A at 30 keV, have been obtained. The electrical efficiency is approximately 85% and the gas efficiency >40%. Experiments show that the neutral beam power which reaches the CLEO plasma represents 33% of the total power in the ion beam. Neutral beam powers of approximately 50 kW have been injected, and measurements on a calorimeter facing the injector indicate that most of the injected beam is ionized in the plasma. (GE)

**1806** CLASSICAL DIFFUSION DUE TO THERMAL EQUILIBRIUM FLUCTUATIONS IN THE DC OCTUPOLE. Tamano, T.; Prater, R.; Ohkawa, T. (Gulf General Atomic, Inc., San Diego, CA). (1973). vp.

From third international symposium on toroidal plasma confinement; Garching, Germany (26 Mar 1973).

"Classical" diffusion due to thermal equilibrium fluctuations was experimentally observed in the dc Octopole. Measurements of the magnitude and of the dependences of this diffusion coefficient on plasma parameters are presented. "Classical" diffusion due to thermal equilibrium fluctuations is of interest with respect to plasma confinement. This diffusion can exceed classical diffusion due to binary electron–ion collisions when the plasma dielectric constant is small. This regime is investigated in the dc Octopole. The results with the toroidal field indicate that the shear is ineffective in modifying the diffusion when the perpendicular diffusion damping time is shorter than the parallel phase mixing time. (GE)

**1807** TURBULENT HEATING IN COUNTERSTREAMING ELECTRON BEAM–PLASMA SYSTEMS. Yatsui, K.; Irie, T.; Yatsuzuka, M. (Osaka Univ.). Phys. Lett.; 45A: No. 3, 199-200(24 Sep 1973).

Counterstreaming electron beam–inhomogeneous magnetoplasma interactions were studied experimentally. Cross-field current arises leading to strong lf turbulences, which results in the considerable heating of ions perpendicular to magnetic field together with the conspicuous reduction of plasma potential. (auth)

**1808** ASYMMETRIC TORSATRON WITH A THREE-DIMENSIONAL MAGNETIC AXIS. Loktionov, Y.M.; Sebko, V.P.; Tyupa, V.I. Sov. Phys.-Tech. Phys. 17: No. 11, 1775-1776 (May 1973).

Asymmetric torsatrons and various combinations of these devices with asymmetric stellarators are analyzed. These systems have several important advantages: the "transparency" of the helical winding, the large useful volume, and the possibility of forming magnetic surfaces and minimum $\bar{H}$ even in the absence of a magnetic field $H_0$. (auth)

**1809** NUMERICAL CALCULATION OF EQUILIBRIUM IN A TOKAMAK. Dnestrovskii, Y.N.; Kostomarov, D.P.; Popov, A.M. (M. V. Lomonosov Moscow State University). Sov. Phys.-Tech. Phys. 17: No. 11, 1771-1774 (May 1973).

The equilibrium of an axisymmetrical toroidal plasma inside an ideally conducting wall with circular or elliptical cross section is analyzed. The problem is solved by numerical integration of the equations of ideal magnetohydrodynamics. The equilibrium state is investigated for various plasma pressures for a uniform current distribution and a distribution decreasing toward the boundary. For an elliptical wall the displacement of the maximum density point is obtained as a function of the semiaxis ratio of the ellipse and the parameter $\beta_1$. The influence of a vertical stabilizing field $H_{z0}$ on the equilibrium is investigated. (auth)

**1810** POWER ABSORPTION IN A NONUNIFORM COLLISIONLESS MAGNETOPLASMA. Brownell, J. (Institute for Plasma Research, Stanford University, Stanford, California). Phys. Fluids 16: No. 7, 1167-1168 (July 1973).

It is shown that a nonuniform collisionless magnetoplasma may absorb power from an external source through the excitation of a large number of radially varying electrostatic modes. If a randomizing mechanism is present, irreversible plasma heating can take place. (auth)

**1811** EFFECT OF MAGNETIC FIELD ERRORS ON CONFINEMENT IN BUMPY TORI. Sprott, J.C. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). Phys. Fluids 16: No. 7, 1157-1159 (July 1973).

Numerical calculations of field line trajectories and drift orbits show that small field perturbations can destroy the single particle confinement in bumpy tori. Criteria are derived for tolerable field errors assuming neoclassical diffusion. (auth)

## Diagnostics

*Refer also to abstracts 239, 1793, 1794, 1856, 1864, 1867, 1905, and 1911.*

**1812** (COO-3421-7) ELECTRON DENSITY MEASUREMENT OF AN ELECTROSTATICALLY-CONFINED, SPHERICALLY SYMMETRIC, HELIUM PLASMA USING A MICROWAVE CAVITY RESONANCE SHIFT TECHNIQUE. Grush, W. H. (Pennsylvania State Univ., University Park (USA)). Aug 1973. Contract AT(11-1)-3421. 71p. Dep. NTIS $5.75.

Thesis.

Microwave resonant cavity frequency shift measurements are made to determine the electron density of an electrostatically confined, spherically symmetric helium plasma. Appropriate electron-density distribution functions are assumed and then used to relate the frequency shift to the central electron density. Results from electron injection, with currents of up to 200 mA, accelerating voltages from 100 to 450 V, and pressures of 5.0, 1.0, and 0.5 mTorr, suggest that a potential well is formed and that the minimum value of perveance required for well formation depends on the accelerating voltage and the pressure. Maximum electron densities of $9.5 \times 10^9/cm^3$ are measured. Electron densities of $5.5 \times 10^9/cm^3$ are measured during ion injection with currents of up to 20 mA at accelerating voltages between 0.5 kV and 5.0 kV and pressures of 5.0, 1.0, and 0.5 mTorr. Electron densities measured during ion injection show remarkable agreement with those predicted by an earlier theoretical model. (auth)

**1813** CALORIMETRIC PROBES FOR MEASURING THE DECELERATION TEMPERATURE AND TOTAL PRESSURE IN HIGH-DENSITY PLASMA FLOWS. Petrov, M. D.; Sepp, V. A. pp 20-33 of Teploobmen v Vysokotemperaturnom Potoke Gaza. Zhukauskas, A. (ed.). Vil'nyus, USSR; Izdatel'stvo Mintis (1972). (In Russian).

A small cross-section of plasma flow is trapped in a probe receiver. The gas heat is transferred to a stream of water whose flow and heat are measured. The gas enthalpy is determined by dividing the energy diverted to the calorimeter by the mass flow through the instrument. Small probes having a single and also two independent means of cooling the gas are described. The temperature and total pressure in high-density plasma flows (both below and above the sonic barrier) were measured with a 6% error for a probe with a single system of cooling, and with a 4% error for the probe with two cooling systems at gas temperatures of 3000°K. Temperature profiles and total pressure were determined on a wide variety of jets. (SJR)

**1814** INADEQUATE REFERENCE ELECTRODE. A Widespread Source of Error in Plasma Probe Measurements. Chang, J. S. (York Univ., Toronto). J. Phys., D (London); 6: No. 14, 1674-1683(18 Sep 1973).

An analysis was conducted on the influence of the reference-electrode area on probe characteristics taken in the electron-retarding range of potentials, when the reference electrode, and perhaps also the probe, is in the "blocking-effect" regime (where probe dimensions are greater than or equal to the electron and ion mean free paths). A new and more severe criterion for sufficiency of reference-electrode area is derived, and it is shown that insufficiency of reference area can lead not only to rounding of the "knee" of the probe characteristic, but can cause an extra, spurious, near-linear section to appear in the (log current against potential) characteristic near space potential, leading to the possibility of grossly inaccurate electron-temperature measurements. A number of published results are cited to show that this phenomenon is in fact a frequent source of error in probe measurements. (auth)

**1815** IONIZATION EFFECTS IN PLASMA. Grabowski, B. (Higher Pedagogical School, Opole, Poland). Acta Phys. Pol.; A44: No. 4, 565-598(Oct 1973).

Two effects are discussed: 1) line merging at the series limit, and 2) lowering of the ionization energy in plasma. The first problem is considered on the basis of the Mozer and Baranger (1960) field-strength distribution functions. A relation was obtained (in the Inglis–Teller model) useful for determining electron density. When passing to the Holtsmark distribution, the relation reduces to the Griem (1964) one. The second problem is considered from the standpoint of the tunnel effect. Comparing a) spontaneous and b) tunnel depopulation of atomic levels, the relation was obtained between external electric field-strength (or electron density) and the principal quantum number of the last quantized level of the hydrogen atom. (26 references) (auth)

**1816** DETERMINING THE ELECTRON TEMPERATURE AND CONCENTRATION IN A NONISOTHERMAL NITROGEN PLASMA BY A SPECTROSCOPIC METHOD. Berdichevskii, M. G.; Marusin, V. V. Zh. Prikl. Spektrosk.; 18: No. 6, 1055-1057(Jun 1973). (In Russian).

At present there is no universal method for the spectroscopic measurement of electron temperature and concentration in a nonisothermal, low-temperature plasma having a low electron concentration ($10^9$ to $10^{13}$ $cm^{-3}$). However, these measurements may be possible for separate gases. The proposed method of measuring electron temperature and concentration is based on measuring the absolute populations $C^3P_1$ and $B^2\Sigma_u^+$, which are upper levels, respectively, of the second positive and first negative systems $N_2$ and $N_2^+$. The electron concentration $N_e$ is calculated for the case that the concentration of one kind of excited molecule equals that of the other $N_1 = N_2 = 10^{10}$ $cm^{-3}$ and the concentration of neutral molecule $N_0 = 10^{16}$ $cm^{-3}$. At other values of these parameters the curves are displaced parallel to the ordinate. It is shown that it is possible to determine the electron concentration $N_e$ with good accuracy independent of the form of the distribution function for electron velocities. (SJR)

**1817** LIGHT SCATTERING FROM WEAKLY IONIZED NONHOMOGENEOUS PLASMAS. Vriens, L. (Phillips Research Labs.; Eindhoven, Netherlands). Phys. Rev. Lett.; 30: No. 13, 585-588(26 Mar 1973).

Rayleigh scattering is used to obtain the radial gas density and temperature distributions in low-current Ar arcs. A comparison with spectroscopic results indicates large deviations from local thermodynamic equilibrium. The possibilities of determining excited-state density distributions and transition probabilities by Rayleigh scattering are indicated. (auth)

**1818** CONTINUUM THICK-SHEATH PROBE STUDIES IN HYPERSONIC IONIZED BOUNDARY LAYERS. Touryan, K. J. (Sandia Labs., Albuquerque, NM); Boyer, D. W. pp 223-234 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

Extensive studies were made of the sheath structure and current collection characteristics of flush-mounted electrostatic probes installed on the dielectric surface of a sharp, leading edge flat plate in an ionized hypersonic flow environment. The studies included experimental and numerical investigations of the effect of probe size, geometry, applied voltage, and local hypersonic boundary layer properties on the current–voltage characteristics of the probes. Test conditions were such that the sheath was collisional and often constituted an appreciable part of the boundary layer. (auth)

**1819** REVIEW OF ELECTROSTATIC PROBE RESPONSE IN A FLOWING, LOW DENSITY PLASMA. Talbot, L. (Univ. of California, Berkeley). pp 235-255 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

The more recent results concerning the use of electrostatic or Langmuir probes for the determination of electron density and temperature in ionized gas flows are reviewed. Special attention is directed mainly to results that have received experimental verification and in general is concerned more with experimental than with theoretical findings. (MOW)

**1820** MEASUREMENT OF NONISOTROPIC ELECTRON VELOCITY DISTRIBUTIONS BY LASER SCATTERING. Phipps, C. R. Jr.; Bershader, D. (Stanford Univ., CA). pp 257-283 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

Electron velocity distributions are deduced along axes parallel and perpendicular to the magnetic field in a pulsed, linear Penning discharge in hydrogen by means of a laser Thomson scattering experiment. Results obtained are numerical averages of many individual measurements made at specific spacetime points in the plasma evolution, and take advantage of the high level of reproducibility of density and velocity parameters possible in this type of discharge. Observation solid angles are made quite small to maximize resolution between the two distributions. Because of the high resolution in k-space and the relatively low maximum electron density ($2 \times 10^{13}$), special techniques were required to obtain measurable scattering signals. These techniques are discussed and preliminary experimental results are presented showing surprisingly good fit between both distributions and a calculated maxwellian. Approximately equal longitudinal and azimuthal temperatures were found at the center of the plasma just before the end of the discharge pulse. Further work is in progress. (auth)

**1821** ELECTROMAGNETIC INTERACTIONS WITH TURBULENT PLASMAS. Guthart, H.; Graf, K. A. (Stanford Research Inst., Menlo Park, CA). pp 285-302 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

The interaction of electromagnetic energy with turbulent media has been a subject of interest for several years. The rigorous calculation of the interaction is very formidable. As a consequence, experiments were conducted on a plasma in a turbulent jet where the electron density distribution and statistics were carefully measured. Comprehensive diagnostic measurements were made on the plasma. The measurements of the mean and rms electron density distribution, of the correlation coefficient of electron density fluctuations, and of the mean flow velocity were made using electrostatic probes. The microwave scattering properties of the turbulent plasma were measured at 9 and 31 GHz for variable electron density. The experimental measurements are compared with theoretical predictions based on a nonrigorous scattering model. The scattering model considers the diffraction effects of the scattering volume, the effect on mean plasma properties, and the attenuation of waves traversing the medium. The agreement between the calculations and experimental measurements is excellent. Similar agreement is achieved between calculations based on the proposed model and experiments performed at other laboratories. (auth)

1822 BEHAVIOR OF A POSITIVE PROBE IN HIGH-SPEED COLLISION-FREE PLASMA FLOW. Taillet, J.; Brunet, A.; Fournier, G. (Office National d'Etudes et de Recherches Aerospatiales, Chatillon, France). pp 317-328 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921-.

It is shown, by numerical computation and by experimental investigation, that a positive body immersed in a mesothermal plasma flow is not surrounded by a sheath in the usual sense, and that the applied potential spreads out over a large distance compared to the Debye shielding radius. Application of this concept to satellite-borne electrodes and probes is suggested. (auth)

1823 ELECTRON DENSITY AND COLLISION FREQUENCY STUDIES USING A RESONANT MICROWAVE CAVITY AS A PROBE. Freeman, R. H. Denton, TX; North Texas State Univ. (1973). 266p. University Microfilms Order No. 73-22,842.

Thesis (Ph. D.).

Electron densities and collision frequencies were obtained on a number of gases in a dc discharge at low pressures (0.70–2 mm Hg). These measurements were performed by microwave probing of a filament of the dc discharge placed coaxially in a resonant cavity operating in a $TM_{010}$ mode. One of the main features of this investigation is the technique of differentiating the resonance signal of the loaded cavity in order to make accurate measurements of the resonant frequency and half-power point frequencies. Measurements in the positive column of the dc discharge for a number of gases (argon, helium, carbon monoxide, deuterium, hydrogen, nitrogen, oxygen, carbon dioxide, nitrous oxide, and gas mixtures) were found to display the following results: Electron densities increased with increasing discharge current and with increasing gas pressure in the pressure range measured (0.7 to 2.0 mm of Hg). Electron collision frequencies were found to be nearly independent of discharge current for some gases probed at the high end (above 1000 $\mu$) of the measured pressure range. Several anomalous effects, including negative frequency shifts and resonance phenomena, were observed. These phenomena were attributed to probing in the negative glow region of the dc discharge, and to striations (ionization waves). (Diss. Abstr. Int., B)

1824 MEASUREMENT OF PLASMA DENSITY DISTRIBUTION USING AN OPEN BARREL-SHAPED CAVITY. Moskalev, I.N.; Stefanovskii, A.M. Sov. Phys.-Tech. Phys. 17: No. 11, 1807-1812 (May 1973).

The radial density distribution of an axisymmetrical plasma is found from the resonant frequency shifts of an open barrel-shaped cavity operating in seven different modes in the eight-millimeter band. The method of regularization developed by A. N. Tikhonov for the Fredholm equation of the first type is used for analysis of the experimental data. The effect of errors in the frequency shift measurements on the resultant density distribution is examined. The density distributions obtained with the cavity measurements are compared with Langmuir probe measurements. (auth)

1825 EFFECT OF FIELD DISTORTIONS IN REFLECTING ANALYZERS FOR CHARGED PARTICLES. Kurdyumov, V.N.; Pervushin, I.I. Sov. Phys.-Tech. Phys. 17: No. 10, 1741-1745 (Apr 1973).

Reflecting analyzers are a new type of instrument for the angle and energy anlysis of low-energy plasma fluxes. The experimental characteristics show that electrostatic field distortions near the grid have an effect on the focusing of the reflected-particle flux. A method is proposed for the analytical derivation of the characteristics with these distortions taken into account. In the trajectory calculations conformal mapping is used to derive expressions for the spatial distributions of the potential and field of an isolated charged grid and a capacitor, one electrode of which is such a grid. The calculated characteristics are in good agreement with the experimental curves. The analytical method can be used in the design of electrostatic analyzers and focusing systems with high-transmission grids for which the radii of curvature and spacings of the electrodes are large in comparison with the grid mesh size. (auth)

1826 COMPARISON OF LANGMUIR DOUBLE PROBE AND LASER SCATTERING MEASUREMENTS OF PLASMA PARAMETERS. J. Irisawa; John, P.K. (Department of Physics, University of Western Ontario, London, Ontario, Canada). Rev. Sci. Instrum. 44: No. 8, 1021-1023 (Aug 1973).

Langmuir double probe and Thomson scattering measurements of density and temperature were made on a plasma with a view to estimating the reliability of probe measurements. The plasma used was the afterglow of a small $\theta$-pinch plasma for which density and temperature were of the order of $10^{15}$ $cm^{-3}$ and 1 eV, respectively. There was close agreement between probe measurement and scattering measurement of the electron temperature while the density as measured by the probe was lower by a factor of about 4 as compared to the scattering measurement. (auth)

1827 STABILIZED AND CALIBRATED MICHELSON INTERFEROMETER. Küpper, F.P.; Mastop, W.J. (Association Euratom-FOM, FOM-Instituut voor Plasmafysica, Rijnhuizen, Jutphaas, The Netherlands). Rev. Sci. Instrum. 44: No. 8, 954-955 (Aug 1973).

The integral value of the refractive index of a plasma in a toroidal device is measured by a stabilized Michelson interferometer with a HeNe gas laser ($\lambda = 0.63$ $\mu$) as light source. A calibrated phase modulator enhances the accuracy with which small phase shifts are measured, and automatically indicates phase shifts exceeding $\pi/2$. (auth)

1828 DETERMINATION OF ELECTRON TEMPERATURE OF SHOCK-HEATED PLASMA FROM MICROWAVE MEASUREMENTS. Singer, A. (Department of Electrical Engineering, The Johns Hopkins University, Baltimore, Maryland 21218); Minkowski, J.M. Phys. Fluids 16: No. 7, 1176-1177 (July 1973).

It is shown that the anomalous results reported for microwave measurements of electron temperature of shock-heated plasma in the range of Mach 9.7 to 10.4 were due to an incorrect model for relating the measured plasma parameters to the electron plasma temperature. A corrected model removes the anomaly. (auth)

1829 APPLICATION OF CYLINDRICAL LANGMUIR PROBES TO STREAMING PLASMA DIAGNOSTICS. Segall, S.B.; Koopman, D.W. (Institute for Fluid Dynamics and Applied Mathematics, University of Maryland, College Park, Maryland 20742). Phys. Fluids 16: No. 7, 1149-1156 (July 1973).

The current-voltage characteristics of cylindrical probes in a high velocity collisionless plasma flow have been investigated experimentally and theoretically. The plasma was generated by a focused laser pulse incident on a metallic target in vacuum, with an expansion velocity U, such that $kT_i/M_i < U^2 < kT_e/m_e$. An analysis, developed from a stationary plasma analog to the flowing case, demonstrated a failure of plasma shielding of probe potential in the electron attracting region, even when $\lambda_D = (kT_e/4\pi n_e e^2)^{(1/2)} < R$, the probe radius. Under these conditions, modifications of relatively simple previous treatments were found to be valid for computing electron current to a probe. The electron characteristics derived from the present analysis agree well with experimental results for a voltage range of typically $-5kT_e/e < V < +3kT_e/e$ around plasma potential. The ion and electron portions of the characteristics are consistent with each other and with independent diagnostic measurements. (auth)

1830 MEASUREMENT OF NONRESONANT ABSORPTION IN A FULLY IONIZED PLASMA. Weisbach, M.F.; Ahlstrom, H.G. (University of Washington, Seattle Washington 98195). Phys. Fluids 16: No. 7, 1164-1166 (July 1973).

Measurements have been made of the absorption of $CO_2$ laser light at 10.6 $\mu m$ by a fully ionized argon plasma. These values are compared with the theoretical values which are calculated from the measured electron densities and temperatures in the plasma. (auth)

## Kinetics (General)

*Refer also to abstracts 1266 and 1291.*

1831 (GULF-GA-A-12690, pp 65-89) dc OCTUPOLE. 15 Sep 1973.

In controlled thermonuclear research program.

Plasma diffusion studies are briefly described in terms of the temperature dependence of neoclassical diffusion and classical diffusion resulting from thermal equilibrium fluctuations. Diffusion in the octupole field only is also described. (MOW)

1832 DYNAMICS OF IONIZED GASES. Proceedings of the International Symposium, Tokyo, Japan, September 13–17, 1971. Lighthill, M. J.; Imai, I.; Sato, H. (eds.). New York; John Wiley and Sons, Inc. (1973). 555p. (CONF-710921-).

Separate abstracts were prepared for 31 of the 38 papers, the remaining 7 papers not being in scope for NSA. (MOW)

*For abstracts of individual papers see: 1340, 1351, 1802, 1818–1822, 1833–1838, 1840–1842, 1852–1854, 1866, 1867, 1876, and 1917–1924.*

1833 MAGNETIC SHEATH ADJACENT TO ABSORBING SURFACES. Lam, S. H. (Princeton Univ., NJ). pp 193-205 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921-.

The steady flow of a collisionless plasma about a solid body with characteristic length L in the presence of a magnetic field is considered. The case when $\lambda_D \ll \lambda_M \ll L$, where $\lambda_D$ and $\lambda_M$ are the Debye length and magnetic Debye length, respectively, is considered. The existence and structure of a magnetic sheath near the solid surface are studied. (MOW)

**1834** PENETRATION AND CROSSING OF TRANSVERSE MAGNETIC FIELD BARRIER BY A PURELY IONIC PLASMA. Baribaud, M., Dolique, J. M.; Zadworny, F. (Univ., Grenoble, France). pp 347-354 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

Penetration and crossing of a transverse magnetic field barrier by a purely ionic $H^+$, $H^-$ plasma were experimentally and theoretically studied. Although the electric field distribution which allows the crossing is profoundly different from what it is in an ordinary plasma, a critical field was also found. The approach to this field was studied. Phenomena not observed with ordinary plasmas were observed with an ionic plasma; a fraction of plasma continues to cross the barrier when the barrier height exceeds the critical field. (auth)

**1835** PLASMA WIND TUNNEL FOR MAGNETOHYDRODYNAMICS. Kuriki, K.; Inutake, M.; Suzuki, J. (Tokyo Univ.). pp 363-373 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

In a plasma wind tunnel of quasi-steady operation diagnostic studies were made on a free plasma stream. The coverage of the Alfvén Mach number $M_A$ and Mach number M is shown in an $M_A$–M diagram. An effort was made to reduce the fluctuation in the flow. (auth)

**1836** INTERACTION OF IONIZED ARGON FLOW WITH ELECTRIC AND MAGNETIC FIELDS. Forestier, B.; Fontaine, B.; Valensi, J. (Institut de Mecanique des Fluides, Marseille). pp 423-440 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

A theoretical and experimental investigation was carried out on the effects of electric and magnetic fields applied to a supersonic stream of ionized argon in MHD power generation as well as the production of high-enthalpy, high-speed flow. The theoretical study using a quasi-steady model was performed for a general case in which Lorentz forces tend to accelerate the plasma. (auth)

**1837** INTERACTION OF PLASMA STREAMS WITH A NEUTRAL GAS CLOUD. Kubo, H.; Kawashima, N.; Itoh, T. (Tokyo Univ.). pp 509-522 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

The interaction of plasma streams with a neutral gas cloud was studied using gun-produced plasma. From time-resolved photographs of the interaction of a quiet plasma stream, valuable information on the process of shock wave growth was obtained, and the experimental results are explained in terms of the snowplow model. The interaction of a quiet plasma stream shows a stable normal shock structure, but that of a plasma stream having turbulent magnetic fields shows a very complicated structure which resembles the ray structure of the type-1 comet tail. Ionization of target gas by a plasma stream is also studied and it indicates that the target gas is ionized mainly by the shock-heated plasma electrons. (auth)

**1838** QUASI-STEADY PLASMA ACCELERATION. Jahn, R. G.; von Jaskowsky, W. F.; Clark, K. E. (Princeton Univ., NJ). pp 523-545 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

A coaxial plasma accelerator driven by protracted pulses of current in the range of $10^4$ to $10^5$ amp and synchronized mass flows from 1.0 to 36g/sec argon attains, after some tens of μsec, a stable magnetoplasmadynamic acceleration mode. This "quasi-steady" discharge form is characterized by constant terminal voltage and current, a diffuse, fixed-current distribution within the discharge, and a steady plasma efflux at velocities of approximately $2 \times 10^4$ m/sec. Measured potential distributions reveal that the bulk of the arc voltage gradient, exclusive of the electrode falls, occurs within two diameters of the cathode, and is normal to it. The anode fall voltage varies inversely with local current density, implying substantially lower anode losses at higher power arc operation. Chamber pressures and impact pressure distributions within the exhaust are mapped with piezoelectric sensors and show that the total thrust can be well correlated with the sum of a calculated electromagnetic component and a measured electrothermal contribution. Spectroscopic, potential, and velocity measurements indicate the existence of a characteristic mass flow rate for a given current, below which arc operation becomes erratic. (auth)

**1839** ENERGY DEPOSITION OF A FAST DEUTERON IN A HOT DEUTERIUM PLASMA. Evans, F. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544). Phys. Fluids 16: No. 7, 1011-1020 (July 1973).

The spatial and temporal distribution of the energy deposited by a fast deuteron in a hot deuterium plasma is calculated taking into account energy loss to thermal ions by scattering that results from elastic nuclear processes in addition to the usual Coulomb interaction with thermal electrons and ions. The method of calculation and the approximations involved are discussed, and numerical results are given for a deuterium plasma at normal liquid density. For plasma electron temperatures above approximately 10 keV, the effect of including nuclear processes in d–d scattering is to cause the energy of a fast deuteron to be deposited nearer to its point of origin in space and time with relatively more energy going directly to ions. (auth)

# Kinetics (Experimental)

*Refer also to abstract 2053.*

**1840** EXPERIMENTAL INVESTIGATIONS ON ARC-HEATED STEADY PLASMA FLOW. Yoshikawa, T.; Murasaki, T. (Osaka Univ.). pp 329-345 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

In order to keep a highly ionized flow up to the region far downstream, a conventional type of plasma jet is remodeled into a novel one with a ring anode. The anode ring is situated downstream in the low pressure region away from the nozzle position of the jet generator. Application of the magnetic field to control the supersonic plasma was substantially effective in a case where the Hall parameter of the electron was greater than unity. Thus, a steady-state isothermal supersonic plasma of reasonable size with electron density orders of $10^{13}$ to $5 \times 10^{14}$ $cm^{-3}$ and temperature between $10^4$ °K to $2.5 \times 10^4$ °K was produced. An experimental investigation of the flow field around an obstacle placed in supersonic plasma stream was carried out. An isothermal magnetogasdynamic shock wave is observed when Alfvén number is greater than unity. On the other hand, when it is as low as a quarter, a highly compressed region is observed surrounding the model. (auth)

**1841** STREAMING PLASMA INTERACTION WITH VARIABLE LONGITUDINAL MAGNETIC FIELDS. Siambis, J. G.; Johnson, B. W.; Kramer, W. R. (Carnegie-Mellon Univ., Pittsburgh). pp 355-361 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

The interaction between a supersonically streaming plasma and a spatially increasing longitudinal magnetic field and also the axial injection into a mirror machine were investigated experimentally. The object of these experiments was to obtain qualitative and quantitative data on these interactions and, in particular, the transition from supersonic to subsonic flow and the attendant shock formation. This transition and shock formation was observed in both experiments for the higher applied magnetic field cases. The helium plasma beam was produced by a conical theta-pinch gun driven by a capacitor bank with a stored energy of 2.5 kJ. Measurements were made of the plasma density, temperature, and streaming velocity. The experimental results are compared to and found in qualitative agreement with an existing theory which predicts the parameter values for the formation of a shock in a related geometry. (auth)

**1842** FORMATION AND DECAY OF VORTEX FILAMENTS IN A PLASMA CURRENT SHEATH. Bostick, W. H.; Nardi, V.; Prior, W. (Stevens Inst. of Tech., Hoboken, NJ). pp 375-392 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

Image-converter photographs of the current sheath in a coaxial accelerator show that the sheath is corrugated and the filamentary structures lie in the grooves of these corrugations. Various photographs taken under different conditions are described. (MOW)

**1843** DIFFUSION PULSE TECHNIQUE APPLIED TO MAGNETICALLY CONFINED HIGHLY IONIZED ARGON PLASMA. Puls, L. G. Jr. Boulder, CO; Univ. of Colorado (1973). 96p. University Microfilms Order No. 73-23,290.

Thesis (Ph. D.).

The transport of charged particles transverse to the magnetic field confining a highly ionized argon plasma is examined. The transport is experimentally analyzed by a technique involving a small-density pulse perturbation and Langmuir probe diagnostic measurements taken in magnetic fields of 930 and 1130 G at 1 mtorr neutral pressure. The particle densities ranged from $3.9 \times 10^{12}$ to $2.0 \times 10^{13}$ cm$^{-3}$. The time- and space-resolved results are compared with numerical calculations based on diffusional transport due to the density and electron-temperature gradients. At steady-state densities near $1.0 \times 10^{13}$ cm$^{-3}$, the best agreement is made with the diffusion model characterized by the electron–ion collisional ambipolar coefficient, whereas at densities near $5.0 \times 10^{12}$ cm$^{-3}$ the Taylor stochastic maximum diffusion coefficient shows the best agreement with the experimental data. The Braginskii kinetic theory coefficient shows the best agreement in thermal diffusion. Results indicate that the transport is diffusional in nature, with a strong dependence in character on the region of the inhomogeneous plasma in which the transport takes place, and the electron temperature gradients are significant in the determination of transport in this plasma. (Diss. Abstr. Int., B)

**1844** X-RAY SPECTRA IN THE ST-TOKAMAK. von Goeler, S.; Stodiek, W.; Sauthoff, N.; Selberg, H. (Princeton Univ., NJ). (1973). vp.

From third international symposium on toroidal plasma confinement; Garching, Germany (26 Mar 1973).

The high-energy electron component produced by electron runaway in the toroidal electric field of the ST-Tokamak was investigated by bremsstrahlung measurements. A quantitative comparison is made of the concentration of the high energy component with a model in which continuous production of runaway electrons in the center of the discharge is balanced in steady state by continuous loss. X-ray spectra were measured at 14, 27, and 40 msec in the discharge. A free-fall distribution was fitted to the measured spectrum at 14 msec, and it was calculated how it should displace with time. The steady state of the electron distribution reached in times short to the discharge time indicates a confinement time of the high energy electrons of about 10 to 20 msec. (GE)

**1845** MAGNETIC COMPRESSION OF TOROIDAL PLASMA IN TUMAN-2 DEVICE. Beresovskii, E. L.; Gusev, V. K.; Kaganskii, M. G.; Kalmikov, S. G.; Kislyakov, A. I.; Mayshev, G. M.; Ovsyannikov, V. A.; Pautov, V. L.; Razdobarin, G. T.; Sokolova, L. V. (Ioffe Inst. of Physics and Tech., Leningrad). (1973). vp.

From third international symposium on toroidal plasma confinement; Garching, Germany (26 Mar 1973).

Experiments on plasma column compression at a magnetic field increasing from 3 to 12 kG for 120 μs are described. Appreciable decrease in plasma oscillations is observed at the compression. A 3.5-fold increase in plasma concentration and a 2.5-fold increase in electron temperature are obtained. Magnetic probes are used to check the equilibrium. The working gas is hydrogen at a pressure of $2 \times 10^{-4}$ torr. The measurements are made after intense discharge cleaning. A preliminary plasma heating is carried out by 5 kA, 2.5-ms ohmic current at a magnetic field of 3.2 kG. From laser scattering experiment, the electron temperature in the column center is (20 ± 5) eV. The energy confinement time is equal to 20 to 30 μsec (from diamagnetic measurements). Electron temperature and concentration near the column axis are measured by ruby laser light scattering. (GE)

**1846** DENSITY DISTRIBUTION OF A STABILIZED ARC PLASMA. Budziak, A.; Gabla, K. (Jagellonian Univ., Krakow). Acta Phys. Pol., A44: No. 2, 319-322(Aug 1972).

An investigation was made of the density distribution in the plasma of an arc stabilized by walls. In the experiment use was made of the double holography method employing as the light source a pulsed ruby laser without cavity modulation. (auth)

## Kinetics (Theoretical)

*Refer also to abstracts 1142, 1143, 1148, and 1940.*

**1847** (BMFT-FBK-73-24) APPLICATION OF A SECOND ORDER METHOD OF CHARACTERISTICS TO PROBLEMS OF GAS AND PLASMA DYNAMICS. Demmig, F. (Technische Univ. Hanover (F.R. Germany). Inst. fuer Plasmaphysik). Aug 1973. 97p. (In German). Dep. NTIS (U.S. Sales Only) $7.00.

An explicit second order method of characteristics for the numerical solution of initial boundary value problems for quasilinear hyperbolic systems of differential equations with two independent variables is discussed, especially with respect to applications. Of primary interest are questions of accuracy, economy, and easy conversion into computer programs. The method is extended to cover computations of shock waves and contact discontinuities. It is specified for a number of applications. (auth)

**1848** (COO-2200-2) NUMERICAL SIMULATIONS OF PLASMAS WITH SMOOTHING IN PHASE SPACE AND FILTERING IN TIME. Progress Report, October 1, 1972–September 30, 1973. Denavit, J. (Northwestern Univ., Evanston, Ill. (USA)). 1973. Contract AT(11-1)-2200. 10p. Dep. NTIS $3.00.

The research is directed toward the development of new numerical methods for plasma simulation and their application to physical problems of current interest to Controlled Thermonuclear Research. During the past year, research on the project has been concerned with the following problems: (1) analysis of numerical effects in particle simulation of whistler wave propagation, (2) theoretical and numerical studies of triggered emissions from electrons correlated in phase by a large-amplitude whistler wave, (3) development of long-time-step algorithms, and (4) anomalous absorption of radiation in weakly collisional plasmas. (auth)

**1849** (COO-3632-17) ENERGY TRANSFER IN A BOUNDED BEAM–PLASMA SYSTEM. Conrad, J. R.; Walsh, J. E. (Dartmouth Coll., Hanover, N. H. (USA). Dept. of Physics and Astronomy). 1973. 9p. Dep. NTIS $3.00.

The dispersion of waves in a bounded beam–plasma system is shown to play an important role in determining the evolution of the velocity distribution. (auth)

**1850** (GULF-GA-A-12690, pp 91-130) THEORY. 15 Sep 1973.

In controlled thermonuclear research program.

Theoretical investigations on the Doublet experiment and the dc Octupole experiment are outlined. The outline includes a summary of the advantages of the Doublet concept over the conventional plasma current device (Tokamak) a discussion of equilibrium, stability, heating, transport, and effects of impurities. (MOW)

**1851** (JINR–P9-7239) CORRELATION FUNCTIONS OF NONISOTHERMAL WEAKLY TURBULENT PLASMA. Abdulloev, Kh. O.; Makhan'kov, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1973. 26p. (In Russian). Dep. NTIS (U. S. Sales Only) $3.50.

An equation is obtained and studied for the correlation functions of nonisothermal isotropic plasma. It is shown that in the region of small wave numbers the width of the Langmuir wave correlation functions is determined by a 4-plasmon interaction, while at large K, by the $l \rightarrow l' + s$ decay process. (auth)

**1852** TURBULENT SHEAR FLOW OF CONTINUUM PLASMA. Chung, P. M.; Marcisz, T. J. (Univ. of Illinois, Chicago). pp 25-46 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

The turbulence structure of weakly ionized, continuum plasma is analyzed with emphasis on the turbulent fluctuation and the transport properties of the ionized species. The mean gradients of the velocity and ionized-species concentrations are considered to be uniform. It is assumed that the turbulence Reynolds number is small and that the turbulence field is homogeneous in order to close the dynamic equations of turbulence. It was found that the ratio of the Debye shielding length to the local integral scale of turbulence must be sufficiently small in order for the detailed quasi neutrality to prevail. The condition of the detailed quasi neutrality is necessary, in addition to the equal mean concentrations of electrons and ions, in order for the turbulence properties involving the electrons to be the same as those involving the ions. (auth)

**1853** LINEARIZED MPD JET AND CHANNEL FLOWS IN EXTERNAL MAGNETIC FIELDS WITH THE HALL EFFECT. Robert, K. (DFVLR Institut fuer Angewandte Gasdynamik, Porz-Wahn, Ger.). pp 413-422 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

The axi-symmetric, steady, and inviscid flow of a diffuse, barotropic arc plasma under the influence of an external magnetic field is analyzed. Both free jet and channel flow inside a nonconducting circular tube, of finite length each, were studied. Since no pressure gradient is to be imposed, all resulting acceleration effects are due solely to the Lorentz force. (auth)

**1854** EXPANSION OF A PLASMA FROM A SPHERICAL SOURCE INTO A VACUUM. Goldfinch, J. M.; Pack, D. C. (Univ. of Strathclyde, Glasgow). pp 441-448 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

Collision integrals are calculated directly from assumed ellipsoidal Maxwellian velocity distributions rather than from a relaxation model. The calculations are made on the basis of Coulomb interactions for charged particle collisions and an inverse fifth-power law for interactions between neutral atoms and charged particles. (MOW)

**1855** TEMPERATURE DISTRIBUTION IN A PLASMA WITH TURBULENT THERMAL CONDUCTIVITY. Inovenkov, I. N.; Rudakov, V. A. (Moscow State Univ.). Sov. Phys.-Tech. Phys. (Engl. Transl.); 17: No. 8, 1416-1418(Feb 1973).

Translated from Zh. Tekh. Fiz.; 17: No. 8, 1769-1771.

The temporal evolution of the temperature profile of a plasma is investigated for the case in which the energy balance is determined by the turbulence thermal conductivity corresponding to the drift-temperature instability. It is shown by numerical calculation that the temperature distribution approaches asymptotically the particular solution of the thermal-conductivity equation which can be obtained by separation of variables. (auth)

**1856** PROJECT AND SIMULATION OF A COMPUTER FOR PLASMA DIAGNOSTICS AND CONTROL. Garcia Gonzalez, F. H. Mexico City; Instituto Politecnico Nacional (1973). 286p. (In Spanish).

Thesis.

The necessity of using a computer for specific purposes is derived from the requirements of the project of plasma diagnostics using electrostatic waves and from the plasma control project using feedback. A description is given of the methods of simple and double electrostatic waves for the determination of electron temperature and the density of the plasma. On the basis of this discussion, equations are determined that have to be calculated on line and off line. Block diagrams are presented for an apparatus that can accomplish this work. Two programs are described for the purpose of verifying that the programs developed by the computer and the general organization of the circuits are correct. The correlation is indicated between the programs of simulation and those of the computer, and logic circuits are presented that are capable of carrying out the machine programs together with the patterns of pulses that cause the execution of each microinstruction. The conclusions include considerations concerning the utility of the simulation as an instrument of design, proposed modifications for the computer, and suggestions for future work. (tr-auth)

**1857** COLLISION OPERATOR IN THE PHYSICAL REPRESENTATION, THE FRIEDRICHS MODEL. De Haan, M.; Henin, F. (Universite Libre, Brussels). Physica; 67: No. 2, 197-237 (15 Jul 1973).

Recent work by the Brussels group has shown the importance of parity properties of the dynamical operators for large systems with respect to the inversion $L \rightarrow -L$, L being the Liouville-Von Neumann operator. This has led to a causal formulation of dynamics. The transformation $\Lambda(L)$ leading from the initial representation (Liouville-Von Neumann equation) to the causal (physical) representation is a nonunitary, called starunitary, transformation. First the general theory is summarized, and the properties of the evolution operator for a dynamical dissipative system in the physical representation are recalled. The Friedrichs model is then studied in detail. Restriction is made to the discussion of the diagonal elements of the density operator in the physical representation and their evolution. This is possible because these elements obey independent equations. One starts with a finite system, and keeps only dominant terms with respect to the volume $L^3$. Then one shows that the Friedrichs model belongs to the class of dynamical dissipative systems, for which an $\mathcal{H}$-theorem can be established. Also for this model, the relation between the causal formulation of dynamics and probability theory is discussed. (auth)

**1858** STATIONARY SOLUTION OF THE FOKKER-PLANCK EQUATION NEAR DETAILED BALANCE. Woehrstein, H. G.; Haken, H. (Univ., Stuttgart). Phys. Lett.; 45A: No. 3, 231-232 (24 Sep 1973).

A perturbational method is presented in order to calculate the exact time-independent stationary solution of the Fokker-Planck equation of systems far from thermal equilibrium and near detailed balance. (auth)

**1859** NON-MARKOVIAN EFFECTS IN PLASMA HYDRODYNAMICS. Baus, M. (Universite Libre, Brussels). Phys. Lett.; 45A: No. 3, 261-262(24 Sep 1973).

A microscopic theory of the linearized plasma hydrodynamical equations is presented and important non-Markovian effects on the plasma transport coefficients are revealed. (auth)

**1860** DEEP INELASTIC ELECTRON SCATTERING IN A NONRELATIVISTIC BOUND STATE MODEL. Bellandi Filho, J. (Instituto de Fisica Teorica, Sao Paulo, Brazil). Rev. Brasil. Fis.; 2: No. 2, 87-94(Aug 1972).

The effect of electron-electron collisions on thermal conductivity of a degenerate plasma is calculated by the perturbation method. Because of this effect, the conductivity is considerably reduced. In the case of a highly degenerate plasma, this effect becomes predominant and the usual formula which is obtained by taking into account only the effect of ion-electron collisions becomes useless. (auth)

**1861** ION KINEMATICS IN A PLASMA FOCUS. Gary, S.P. (Department of Physics, College of William and Mary, Williamsburg, Virginia 23185); Hohl, F. Phys. Fluids 16: No. 7, 997-1002 (July 1973).

The results of numerical integrations of three-dimensional equations of motion of ions subject to given electric and magnetic fields are presented. The fields represent those which may exist in the pinch phase of the plasma focus, although here they depend only on the radial coordinate. The ions initially have Maxwellian velocity distributions, and their trajectories are interpreted in terms of single-particle constants of the motion. Two models of the axial electric field $E_z$ are considered. For strong $E_z$ away from the axis, there is a cyclotron acceleration which leads to ion heating. For positive $E_z$ on the axis, ions within a Larmor radius of the axis undergo very efficient acceleration; the results for this new model are in general agreement with experimental results. (auth)

**1862** OSCILLATION CENTER QUASILINEAR THEORY. Dewar, R.L. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08540). Phys. Fluids 16: No. 7, 1102-1107 (July 1973).

A new formulation of the quasilinear theory of weakly turbulent plasmas is presented, which explicitly separates resonant and nonresonant wave-particle interactions from the outset. This is achieved by making a canonical transformation to "oscillation center variables" before attempting to solve the Vlasov equation. A systematic method of constructing the generating function to any order in the wave amplitude is presented, based on a variant of Hamilton-Jacobi perturbation theory. Momentum and energy split naturally into a wave and a particle component. The results are generalized to apply to weakly inhomogeneous plasmas, and verified by demonstrating momentum and energy conservation. (auth)

**1863** LAMINAR INTERACTIONS IN HIGH MACH NUMBER PLASMA FLOWS. Clark, R.W.; Denavit, J.; Papadopoulos, K. (Naval Research Laboratory, Washington, D.C. 20390). Phys. Fluids 16: No. 7, 1097-1101 (July 1973).

The laminar interaction of counterstreaming plasmas in the presence of a magnetic field was studied by numerical simulation. The model is one-dimensional and is based on the Vlasov equation with straight orbits for ions ($\Omega_i t < 1$). Electrons are treated as a massless, zero-temperature fluid maintaining charge neutrality with the ions, and a finite resistivity is assumed. Magnetic field and density profiles are determined for different Mach numbers, density ratios, and resistivities. Effects of various finite initial density profiles in the streaming plasma are investigated. The distribution function is examined to determine whether microinstabilities would develop in a turbulent model. The relevance of these results to the formation of magnetic pistons is discussed. (auth)

## Production

*Refer also to abstract 1882.*

**1864** (LA-UR-73-1394) EXPERIMENTS WITH LASER-PRODUCED PLASMAS: ELECTRONS, IONS, AND NEUTRONS. Godwin, R. P. (Los Alamos Scientific Lab., N. Mex. (USA)). 1973. Contract W-7405-eng-36. 22p. (CONF-730836-3). Dep. NTIS $3.25.

From third workshop on laser interaction and related plasma phenomena; Troy, New York, USA (13 Aug 1973).

Experimental results, particularly x-ray bremsstrahlung and ion time-of-flight measurements, obtained from plasmas generated with a 10 J, 25 psec Nd:YAG-Nd:glass (1.06 μm) laser delivering focal spot intensities of greater than $10^{16}$ W/cm$^2$ are reviewed. Preliminary experiments with a 10 J, 1 nsec $CO_2$ (10.6 μm) laser delivering ~ $10^{14}$ W/cm$^2$ to a target are briefly discussed. Both sets of experiments yield high-energy (tens of keV) electrons and ions. Experimental evidence indicates that neutron emission can be explained by electron heating and a consequent ion acceleration. Therefore, neutron production in laser-produced plasmas can be a delusive diagnostic. (auth)

**1865** (SLA-73-500) INTERPRETING SELF-GENERATED MAGNETIC FIELD MEASUREMENTS IN LASER-PRODUCED PLASMAS. Widner, M. M. (Sandia Labs., Albuquerque, N. Mex. (USA)). Aug 1973. Contract AT(29-1)-789. 22p. Dep. NTIS $3.25.

Spontaneous magnetic field measurements from a number of reported experiments are compared with numerical simulation calculations using the electron pressure-driven magnetic source ($\dot{B} \propto \nabla T_e \times \nabla n$). Magnetic-field regeneration and strong dissipation can explain many qualitative features of field amplitude and direction measurements. (auth)

**1866** SHOCK WAVE PRODUCTION OF RELATIVISTIC PLASMAS. Taussig, R. (Columbia Univ., New York). Contract AT(30-1)-3954. pp 113-130 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

Recent shock-wave experiments have created high-temperature post-shock plasmas and shock speeds greater than 0.01 c. The feasibility and potential achievements of more energetic shock wave experiments are treated theoretically. Post-shock properties for steady, hydromagnetic relativistic shocks are presented. Scaling laws are derived that give the shock width, power, total energy, and magnetic fields needed to make relativistic post-shock plasmas. The thickness of fast shocks can be reduced by strong magnetic fields. Physical phenomena capable of revealing relativistic features in the plasma are discussed. (auth)

**1867** INITIAL STAGES OF A PRE-IONIZED LINEAR $\theta$-PINCH PLASMA. Irving, J.; Deuchars, W. M.; Thomson, I. (Univ. of Strathclyde, Glasgow). pp 161-165 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

The initial parameters of the preionized z-pinch afterglow were determined by interferometry and spectroscopy. At the initiation of the $\theta$ pinch, the plasma was 25% ionized and had a temperature of $\sim$1 eV. The diagnostic techniques used in the study of the main discharge during the first 0.5 $\mu$sec include (a) high-speed photography with an image-converter camera, (b) magnetic field measurements, and (c) spectroscopy. (MOW)

**1868** ENERGY CHARACTERISTICS OF A COAXIAL PLASMA SOURCE. Belikov, A. G.; Goncharenko, V. P.; Goncharenko, D. K.; Derepovskii, N. T.; Safronov, B. G.; Khizhniak, N. A. pp 200-203 of Plazmennye Uskoriteli. Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). (In Russian)

An experimental coaxial plasma source with electrodes 3 and 14 cm in diameter was used in a study of the plasma energy distribution along the electrode length and in a one-square meter vacuum chamber vs the charge of the capacitor battery. The polarity of the central electrode was found to be an important factor in plasmoid energy control. The energy of a plasmoid in a plasma source of this type increased linearly with the charge of the capacitor battery. (IAA)

**1869** INVESTIGATION OF THE PERFORMANCE OF A COAXIAL ACCELERATOR IN THE PRODUCTION OF A DENSE HIGH-ENERGY PLASMA. Zolototrubov, I. M.; Novikov, Yu. M.; Skoblik, I. P.; Tolstolutskii, A. G. pp 214-218 of Plazmennye Uskoriteli. Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). (In Russian)

**1870** CONTROL OF THE DYNAMIC CHARACTERISTICS OF A PLASMA JET OF A GIVEN COMPOSITION BY SELECTING THE PARAMETERS OF A PULSED ACCELERATOR. Leskov, L. V.; Mukhoian, M. E.; Prianishnikov, V. A.; Savichev, V. V, pp 218-221 of Plazmennye Uskoriteli. Artsimovich, L. A. (ed.). Moscow; Izdatel'stvo Mashinostroenie (1973). (In Russian)

**1871** ROLE OF SPONTANEOUS MAGNETIC FIELDS IN A LASER-CREATED DEUTERIUM PLASMA. Chase, J.B.; LeBlanc, J.M.; Wilson, J.R. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Fluids 16: No. 7, 1142-1148 (July 1973).

Using numerical simulation, it was found that, with the inclusion of thermally-generated magnetic fields, about $3\times10^4$ neutrons are produced in 2 nsec and the electron temperature rose as high as 15 keV in a target heated by a 4-nsec, 80-J laser pulse. (auth)

## Stability

*Refer also to abstracts 1795, 1915, and 1927.*

**1872** (COO-3497-5) ANNUAL PROGRESS REPORT. Simon, A. (Rochester Univ., N. Y. (USA)). 18 Sep 1973. Contract AT(11-1)-3497. 6p. Dep. NTIS $3.00.

The nonlinear analysis of plasma instabilities in the threshold regime is discussed. The emphasis remains on carrying out calculations in realistic geometry and making comparison with experiment. Attention has shifted entirely to fully ionized plasma. An analysis was made of the collisional drift-wave instability. Considerable progress was made in explaining the explosive nature of the mirror-flute instability and in understanding the flute instability in the presence of both density and temperature gradients. The application of the threshold method to parametric instabilities in nonuniform plasma is discussed. Details of the results and comparison with experiment are given. (auth)

**1873** (COO-3632-16) VELOCITY SPACE DIFFUSION AND SPECTRAL NARROWING OF A BEAM PLASMA INSTABILITY. Walsh, J. E.; Conrad, J. R.; Hoffman, G. L. Jr. (Dartmouth Coll., Hanover, N. H. (USA). Dept. of Physics and Astronomy). 1973. 8p. Dep. NTIS $3.00.

A diffusive single wave theory is applied in the regime of the beam–plasma interaction covered by the single wave approximation. The results are compared with the predictions of trapping theory. (auth)

**1874** (FRNC-TH-398) RELATIONS BETWEEN THE EVOLUTION OF THE BEAM-PLASMA INSTABILITY AND THAT OF A LOW FREQUENCY INSTABILITY IN A COLD CATHODE REFLEX DISCHARGE. Lasalle, J. (Paris-11 Univ., 91, Orsay (France)). 1972. 63p. (In French). Dep. NTIS (U.S. Sales Only) $5.25.

Thesis.

It is shown that a low frequency relaxation oscillation in a plasma always accompanies a microwave phenomenon, which decomposes into a frequency vibration and a power relaxation of a hf line predicted by studying the beam-plasma instability. A sampling method was used to determine the time dependence of the principal parameters of the discharge, during a period of relaxation. The electron temperature variation with time gives that of the power emitted by the instability. The electron density variation with time gives the behavior of the computerized dispersion curves for the beam-plasma instability. A detailed investigation of the electron radial diffusion enabled the determination of the influence of the hf heating on the electron density and then the evolution of the hf instability. (FR)

**1875** ION-SOUND INSTABILITY AND ITS ASSOCIATED MULTI-MODEL PHENOMENA. Keen, B. E.; Fletcher, W. H. W. (United Kingdom Atomic Energy Authority, Abingdon, Eng.). J. Phys., D (London); 6: No. 14, 1684-1698(18 Sep 1973).

Results are presented which describe the properties of a single-mode low-frequency ($\omega_0$) instability in a current-carrying plasma at low neutral pressures. Comparison of the results with a linear theory suggests its identification as an ion-sound instability caused by the electron stream in the plasma. At higher neutral pressures, other wave modes are self-excited in the plasma and subharmonics of the fundamental are observed at $\omega_0/4$, $\omega_0/2$, and $3\omega_0/4$, as well as modes at $5\omega_0/4$, $3\omega_0/2$ etc. Theoretical calculations based on a nonlinear equation of the Van der Pol (Phil. Mag., 43: 700-13 (1922)) type are developed. The predictions are compared with the experimental results, and good qualitative agreement is achieved. (auth)

**1876** EFFECT OF DISSIPATION DUE TO FIREHOSE INSTABILITY ON HALF-JET FLOW OF A COLLISIONLESS PLASMA. Morioka, S. (Osaka Univ.); Spreiter, J. R. pp 83-89 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

On the basis of the quasi-linear fluid equations, the effect of collisionless dissipation due to the firehose instability on two-dimensional steady flow is considered. The main discussion is restricted to aligned and perturbation flow. It was found that the dissipation terms are proportional to the fluctuation energy density in the main flow and are nonlinearly related to the other quantities through the growth-rate parameter of instability. (MOW)

**1877** INSTABILITY OF CYCLOTRON WAVE ON THE FINITE AMPLITUDE. Indykul, V. P.; Shevchenko, V. I. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 8, 1287-1300(Aug 1973). (In Russian).

The stability of a monochromatic cyclotron wave of the finite amplitude relative to excitation of its satelites is studied. It is shown that the instability arises due to interaction of waves of the "bowl" type with the particles captured by the fundamental wave. Maximum of the growth increment corresponds to the "violet" sattelite excitation. (auth)

**1878** NONLINEAR HELICAL PERTURBATIONS OF THE PLASMA IN THE TOKAMAK. Kadomtsev, B. B.; Pogutse, O. P.

(Inst. of Atomic Energy, Moscow). Zh. Eksp. Teor. Fiz.; 65: No. 2, 575-589(Aug 1973). (In Russian).

Kink instability of a current-carrying highly conducting column in a strong magnetic field is considered in the general case without assuming the linear approximation. It is shown that helical perturbations should grow into "bubbles", i.e., plasma-free helical plaits which become inserted under the surface of the plasma column. The relation between this process and the so-called disruptive instability is discussed. (auth)

**1879** STABILIZATION OF BEAM INSTABILITY BY THE HIGH-FREQUENCY PRESSURE. Demchenko, V. V.; El-Siragy, N. M. (Atomic Energy Authority, Cairo). Physica; 67: No. 2, 347-366(15 Jul 1973).

The effect of the pressure of an hf field (strictional nonlinearity) induced by a beam of charged particles on the character of beam–plasma interaction is investigated. It is demonstrated that allowance for hf pressure results in two phenomena, which are missing from a linear approximation. Firstly, the instability that arises under conditions of Cherenkov resonance resembling the instability of surface waves degenerates into that of volumetric waves under the effect of the hf pressure. Secondly, which is more important, to a nonlinear approximation the frequency of the excited wave turns out to be dependent on its amplitude (loss of isochronism). The resonance between the beam and the excited waves disappears, thereby reducing the growth rate and with certain parameters the instability might be totally disrupted. Another conclusion, worthy of attention, is that concerning the possibility of a parametric build-up of oscillations in the plasma. The expressions for the wave-amplification coefficients and conditions of the parametric instability are obtained; the instability mechanism is clarified. (auth)

**1880** CONTROL OF THE PLASMA CURRENT AND PLASMA POSITION IN TFR. Cotsaftis, M.; Dei-Cas, R.; Dudon, F.; Ginot, P.; Huguet, M.; Rebut, P. H. (CEN, Fontenay aux-Roses, France). (1973). vp.

From third international symposium on toroidal plasma confinement; Garching, Germany (26 Mar 1973).

In the TFR experiment, the pulse duration of the plasma current is expected to reach 0.5 s. This is much longer than the resistive penetration time of the copper shell and a feedback system must be used to control the plasma position. The primary and equilibrium circuits used have three purposes: to introduce the current into the plasma, to produce the vertical field needed for the equilibrium of the plasma column, and to compensate the transverse stray fields before the breakdown. A numerical code is being written that takes into account all the external circuits: primary, equilibrium circuit, liner, copper shell, plasma, and feed-back loops. This code will give the current evolution in all the circuits and the plasma parameters. (GE)

**1881** NONLINEAR THEORY OF M = 1 KINK MODE. Rosenbluth, M. N. (Inst. for Advanced Study, Princeton, NJ); Dagazian, R.; Rutherford, P. H. (1973). vp.

From third international symposium on toroidal plasma confinement; Garching, Germany (26 Mar 1973).

An analysis is given for the m = 1 kink instability, solving for the amplitude of the helical equilibrium which is reached as a result of the linear instability and for the resulting voltage spike and radial shift of the plasma. A neighboring helical equilibrium is found to result from the m = 1 kink instability. Negative voltage spikes and inward radial shifts are predicted as seen in the "disruptive instability" but the predicted signals are too small. One interesting feature of the solution is a current sheet (zero thickness magnetic island) at the singular surface. A tearing mode of this structure could possibly produce much larger external effects. In fact one would expect any dissipative effects which lead to a settling down into the nonlinear equilibrium to greatly affect the external signals. However, without knowing the nature of the dissipation it is not possible to estimate the magnitude or even the sign of the dissipative effects. (GE)

**1882** MODEL OF PARAMETRIC EXCITATION BY AN IMPERFECT PUMP. Valeo, E.J.; Oberman, C.R. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey, 08540). Phys. Rev. Lett. 30: No. 21, 1035-1038 (21 May 1973).

We examine the three–wave decay instability due to a monochromatic pump with a phase which undergoes a random walk with diffusion coefficient D. Analytic results are obtained for small and large $D/\gamma_0$ (where $\gamma_0$ is the growth rate for $D=0$), which demonstrate, respectively, a fractional reduction of $\gamma$ by $D/\gamma_0$ and a growth rate $\gamma_0^2/D$. Results are also presented for intermediate values of $D/\gamma_0$. (auth)

**1883** SURFACE OSCILLATIONS OF A WEAKLY IONIZED PLASMA IN A MAGNETIC FIELD. Lovetskii, E.E.; Starodub, A.N. (Institute of Engineering Physics, Moscow). Sov. Phys.–Tech. Phys. 17: No. 10, 1612-1614 (Apr 1973).

The stability of the boundary of a plasma in an external magnetic field parallel to the boundary is examined for the case in which the magnetic pressure greatly exceeds the particle pressure. The conditions for excitation of surface oscillations are derived for frequencies of the order of, or greater than the ion cyclotron frequency. The possibility of stabilizing these oscillations by magnetic shear is considered. The effect of charged–particle collisions with neutrals is discussed. (auth)

**1884** EFFECT OF MAGNETIC FIELD CURVATURE ON THE STABILITY OF A PLASMA CONFINED BY A DENSE NEUTRAL GAS. Borisov, N.D. Sov. Phys.–Tech. Phys. 17: No. 10, 1615-1619 (Apr 1973).

The stability of an inhomogeneous plasma with finite pressure is analyzed for the case in which the magnetic lines of force are curved and the pressure gradient in the plasma is very small. An analysis is made of the effect of field curvature on the stability of Alfvén waves in a high–pressure plasma and on the stability of magnetosonic waves with various longitudinal wave numbers. Electron and ion longitudinal thermal conductivities are discussed as a dissipative factor leading to the excitation of magnetosonic waves. The curvature values affecting the stability of waves of both types are found. (auth)

**1885** QUASILINEAR RELAXATION OF A MONOENERGETIC RELATIVISTIC ELECTRON BEAM IN AN EXTERNAL MAGNETIC FIELD. Chogovadze, M.E. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. Phys.–Tech. Phys. 17: No. 10, 1620-1623 (Apr 1973).

The quasilinear relaxation of the longitudinal oscillations of a monoenergetic relativistic electron beam is considered in a bounded plasma in an external magnetic field. It is shown that the quasilinear relaxation of such a beam leads to a smearing out of velocities into a Maxwellian distribution with an anisotropic temperature, as in the absence of a magnetic field. The quasilinear relaxation time, the velocity distribution of the beam electrons, and the amplitude of stable longitudinal waves are determined. It is shown that in a strong external magnetic field the quasilinear relaxation time and the energy of stable oscillations depend critically on the field strength. (auth)

**1886** STRUCTURE OF CURRENT FRONT AND TURBULENT ACCELERATION OF IONS IN A PLASMA ACCELERATOR. II. Aref'ev, V.I.; Leskov, L.V. Sov. Phys.–Tech. Phys. 17: No. 11, 1829-1832 (May 1973).

In Part I a detailed study is made of mechanisms leading to turbulent acceleration of ions, and the current-sheet structure is found when polarization oscillations are excited. Here, the turbulence structure of the current sheet in the fast acceleration regime, for which $v_0 > v_{A1}$, is examined. (LMT)

**1887** STRUCTURE OF THE CURRENT FRONT AND TURBULENT ACCELERATION OF IONS IN A PULSED PLASMA ACCELERATOR. I. Aref'ev, V.I.; Leskov, L.V. Sov. Phys.–Tech. Phys. 17: No. 11, 1822-1828 (May 1973).

In transient acceleration of plasmoids in plasma guns, instabilities are observed on the first plasmoid current front. Under certain conditions these instabilities lead to the disintegration of the current sheet and to the appearance of fast particles. A theory of high–frequency plasmoid instabilities is developed which is based on an analysis of the experimental data and which leads to turbulent heating of the primary ions and impurities. The limiting values of the ion energies are estimated from an analysis of quasilinear equations describing the heating of the ions. The structure of the current sheet is found allowing for both microscopic and large–scale turbulence in the plasmoid. (auth)

**1888** DYNAMIC STABILIZATION OF A TOROIDAL DISCHARGE IN A LONGITUDINAL MAGNETIC FIELD. Vasilevskii, M.A.; Roife, I.M.; Seredenko, E.V. (D. V. Efremov Scientific Research Institute for Electrophysical Apparatus, Leningrad). Sov. Phys.–Tech. Phys. 17: No. 11, 1813-1816 (May 1973).

The stability of a toroidal discharge with constant and high–frequency currents in the longitudinal magnetic field of the Toloskop device is studied. Under the experimental conditions steady–state oscillations of the minor radius of the plasma occur at the frequency of the high–frequency current $\omega$. The results of an experimental determination of the boundaries of stable regions are compared with limits obtained with dynamic stabilization of a plasma column which executes such oscillations. (auth)

**1889** PARAMETRIC EXCITATION OF A PLASMA AT ELECTRON CYCLOTRON HARMONICS. Aliev, Y.M.; Silin, V.P. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. Phys.–Tech. Phys. 17: No. 11, 1767-1770 (May 1973).

Paramagnetic resonance in a magnetized plasma is examined under conditions for which the harmonics of the applied frequency are close to harmonics of the electron cyclotron frequency. Threshold values are determined for the field. The growth rates are calculated. (auth)

**1890** MAGNETIC FEEDBACK STABILIZATION IN A TOKAMAK. Ladikov, Y.P.; Samoilenko, Y.I. (Institute of Cybernetics, Academy of Sciences of the Ukrainian SSR, Kiev). Sov. Phys.–Tech. Phys. 17: No. 10, 1644-1650 (Apr 1973).

A feedback system is analyzed for the magnetic field in a fusion device; the system is based on the use of orthogonal coils, which are coupled inductively to the plasma perturbations. The circuit of each coil is connected to a two-pole system with negative impedance, thus realizing the required reflection coefficient of the perturbed magnetic field. The stabilization of helical perturbations in a plasma is investigated taking account of toroidal corrections. It is shown that the requirements on the longitudinal field can be relaxed by the proper choice of gain. The spatial structure of the coils and the control parameters are discussed. (auth)

**1891** COLLISIONAL RESISTIVITY IN LOW ASPECT RATIO TORI. Coppi, B.; Sigmar, D.J. (Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). Phys. Fluids 16: No. 7, 1174-1175 (July 1973).

The electrical conductivity of a toroidal plasma in the long mean free path limit is evaluated for finite values of the aspect ratio by using physical arguments on the effect of trapped particles. (auth)

**1892** EFFECT OF PARTIAL COHERENCE ON LASER–DRIVEN PLASMA INSTABILITIES. Tamor, S. (Science Applications, Incorporated, La Jolla, California 92037). Phys. Fluids 16: No. 7, 1169-1171 (July 1973).

The two-fluid theory of laser–driven nonlinear plasma instabilities is reformulated to describe imperfectly coherent radiation. For a particular model of the laser noise, the modified dispersion relation is found and a simple estimate for the increase in stability threshold obtained. (auth)

**1893** EFFECT OF KROOK MODEL COLLISIONS ON THE TWO–STREAM INSTABILITY. Gula, W.P.; Chu, C.K. (Columbia University, New York, New York 10027). Phys. Fluids 16: No. 7, 1135-1141 (July 1973).

The effects of Krook model collisions on the electron–electron two–stream instability were investigated by means of a computer code. It was found that a collision frequency small in comparison with the electron plasma frequency delays the onset of saturation of the instability, decreases the total electrostatic field energy at saturation, and lowers the linear growth rates. This last effect is in very good agreement with the growth rates predicted by the linear theory of the Krook equation. (auth)

**1894** EFFECT OF A SURROUNDING GAS ON MAGNETOHYDRODYNAMIC INSTABILITIES IN Z PINCH. Manheimer, W.M.; Lampe, M.; Boris, J.P. (Naval Research Laboratory, Washington, D. C. 20375). Phys. Fluids 16: No. 7, 1126-1134 (July 1973).

The effect of an ionized or un–ionized background on magnetohydrodynamic instabilities in a Z pinch is considered. It is shown that the growth rate may be reduced by at least one or two orders of magnitude even though the background pressure is small compared with the pinch pressure. The stabilizing effect of launching shocks in the background gas is considered qualitatively. It is shown that it is theoretically possible to construct equilibria such that confinement for a Lawson time can be attained, but only for backgrounds of roughly liquid density. Also, it is shown that lightning discharges are stabilized by the presence of the background atmosphere. (auth)

**1895** ANOMALOUS PENETRATION OF A MAGNETIC PULSE INTO A PLASMA. Liewer, P.C.; Krall, N.A. (University of Maryland, Department of Physics and Astronomy, College Park, Maryland, 20742). Phys. Rev. Lett. 30: No. 25, 1242-1245 (18 June 1973).

The penetration of a magnetic pulse into a field–free plasma is calculated by a numerical integration of two–fluid equations which include self–consistently the effects of a time– and space–evolving instability–driven turbulence. This theory explains many of the results of a recently published experiment by Bengtson et al. which measured this effect, and explains the discrepancy between the results of that experiment and the predictions of previously existing models of turbulent resistivity. (auth)

**1896** TOROIDAL EFFECTS ON MAGNETOHYDRODYNAMIC MODES IN TOKAMAKS. Frieman, E.A.; Greene, J.M.; Johnson, J.L.; Weimer, K.E. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08540). Phys. Fluids 16: No. 7, 1108-1125 (July 1973).

In order to investigate the effect of toroidal curvature on magnetohydrodynamic modes in tokamak configurations, stability criteria are derived by means of an expansion in the inverse aspect ratio. For a low–pressure system, $\beta_\theta \sim 1$, with a nearly constant safety factor, $q = q_a^{(0)} + \ldots$, the well known stability criterion for kink modes, relating $q_a$ to the ratio a/b of the plasma radius to that of a conducting wall, is determined in second order. Here, it is shown that toroidal effects modify this criterion favorably in fourth order when the vacuum region does not extend too far. Typically, it is found that improvement is achieved when b/a is less than 1.25 to 1.5. Interchange and ballooning effects are incorporated in the stability criteria. (auth)

**1897** TRANSPORT AND PARTICLE SCATTERING DUE TO TOROIDAL PLASMA MODES. Coppi, B. (Scuola Normale Superiore, Pisa, Italy); Minardi, E. Phys. Fluids 16: No. 7, 1021-1031 (July 1973).

Electrostatic modes are shown to be excited, in two–dimensional plasma equilibrium configurations, with frequency and parity characteristics such as to significantly affect the orbits of trapped ions by proper mode–particle resonances in regimes where the single–particle collision mean free paths are considerably longer than the periodic particle excursions. In particular, new modes driven by the ion temperature gradient are shown to become unstable in the presence of trapped particles under less restrictive conditions and with considerably larger transverse wavelengths than the ion temperature gradient driven modes arising in a one–dimensional equilibrium configuration. The resulting enhancement in the transport of ion thermal energy across the magnetic field is discussed. (auth)

**1898** TEARING MODE IN THE CYLINDRICAL TOKAMAK. Furth, H.P.; Rutherford, P.H.; Selberg, H. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08540). Phys. Fluids 16: No. 7, 1054-1063 (July 1973).

Detailed computational results are presented on the stability and radial distribution of linear tearing modes in cylindrical tokamaks of various radial profiles. In the case of a skin–current profile, a "double tearing mode", with two points of discontinuity in the radial magnetic field perturbation is found. An analytical method is also derived for comparison of the stability of different radial profiles. It is further shown that the tearing mode can be driven by finite electron viscosity, as well as by the usual finite resistivity mechanism. (auth)

**1899** QUENCHING OF THE BEAM– PLASMA INSTABILITY BY MODE MIXING AT A DENSITY DISCONTINUITY. Böhmer, H.; Jackson, E.A.; Raether, M. (Department of Physics and Coordinated Science Laboratory, University of Illinois, Urbana, Illinois 61801). Phys. Fluids 16: No. 7, 1064-1071 (July 1973).

Experiments on the spatial instability of a beam–plasma system led to the observation that the instability is quenched when irradiated by high power microwaves. It is conjectured that this effect is due to a local decrease in plasma density in the irradiated region. A theoretical model is detailed that explains the salient features of the observed effect. Auxiliary measurements on a system with a controlled density gradient are presented that give strong support for the proposed mechanism. (auth)

**1900** LOW–FREQUENCY HYDROMAGNETIC KINK MODE OF A RELATIVISTIC BEAM. Lee, E.P. (Lawrence Livermore Laboratory, University of California Livermore, California 94550). Phys. Fluids 16: No. 7, 1072-1077 (July 1973).

An analysis of the stability of the kink mode of a relativistic charged–particle beam propagating in a toroidally confined plasma is presented. The essential feature is the treatment of the beam as a distinct component of the system having finite velocity and inertia in addition to its current. To simplify the analysis, the plasma background is assumed to be a pressureless, uniform fluid obeying the laws of perfect magnetohydrodynamics while the beam is treated as a cold, rigid body. To simulate toroidal geometry, periodic boundary conditions are imposed in the axial direction of a straight, cylindrical volume. The walls of the cylinder have perfect conductivity. A strong solenoidal field is externally imposed, but the beam is the only source of the poloidal field. It is found that a modification of the stability condition of Kruskal and Shafranov applies; the onset of instability corresponds to the appearance of closed particle orbits rather than the more severe condition of closed field lines. The maximum rotational transform consistent with stability is $\iota/2\pi = 1 + (\beta_z\gamma mc^2)/(eR_0B_z)$. (auth)

**1901** ELECTROSTATIC INSTABILITIES DRIVEN BY VELOCITY GRADIENTS. Hirose, A. (University of Saskatchewan, Saskatoon, Canada); Alexeff, I. Phys. Fluids 16: No. 7, 1087-1096 (July 1973).

It is shown that cross–field gradients of guiding–center drift velocities can excite several high–frequency ($\omega > \omega_{ci}$) electrostatic instabilities. The instabilities can enhance effective interelectron and/or electron–ion collisions which in turn destroy the velocity gradients. In pulsed, turbulent heating experiments, this effect is expected to appear as anomalously rapid current penetration (anomalous skin effect). (auth)

**1902** LOW–THRESHOLD INSTABILITY IN A WEAKLY IONIZED PLASMA. Ivanov, A.A.; Parail, V.V. Sov. Phys.–Tech. Phys. 17: No. 11, 1903-1904 (May 1973).

It is shown that, in a weakly ionized plasma in a homopolar device with a current transverse to the external axial magnetic field, an electrostatic instability can develop when $\nu_{in} > \omega_{Hi} = eH_0/Mc$, $\nu_{en} < \omega_{He}$ (here $\nu_{in}$ and $\nu_{en}$ are, respectively, the collision frequencies of ions and electrons with neutrals); the threshold drift velocity can be much smaller than the acoustic velocity. (LMT)

# Thermonuclear Engineering and Equipment

*Refer also to abstracts 1024, 1025, 2313, and 2407.*

**1903** (BNWL-SA-4773) TRANSMUTATION OF MASSIVE LOADINGS OF $^{137}$Cs IN THE BLANKET OF A CONTROLLED THERMONUCLEAR REACTOR. Gore, B. F.; Leonard, B. R. Jr. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1973. Contract AT(45-1)-2042. 17p. (CONF-731101-6). Dep. NTIS $3.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum and Nuclear Energy Exhibition; San Francisco, California, USA (11 Nov 1973).

Calculations have been performed that indicate the possibility of reducing below ten years the effective half-life for transmutation of massive loadings of $^{137}$Cs placed in a CTR blanket. The blanket studied is a modification of the cylindrical "standard blanket" calculational benchmark, having 1 cm of Nb wall material followed by a 20 cm target zone, 70 cm of moderator and a 6 cm absorber of Li. The "standard blanket" source yielding a wall loading of 10 MW/m$^2$ of 14 MeV neutrons is assumed. Neutron production by (n,2n) reactions in a Be moderator is used to increase the thermal flux. For an 80% target zone loading of $^{137}$Cs, a transmutation rate of 290 kg per year per meter of CTR length is obtained, with a half-life (including radioactive decay) of 9.9 years. At this loading, the transmutation rate is roughly one percent of the length of a CTR blanket would balance the production rate in a fission reactor of the same power. (auth)

**1904** (GULF-GA-A-12690) CONTROLLED THERMONUCLEAR RESEARCH PROGRAM. Summary Progress Report, August 1, 1972–July 31, 1973. Ohkawa, T. (Gulf General Atomic Co., San Diego, Calif). 15 Sep 1973. Contract AT(04-3)-167. 161p. Dep. NTIS $7.60.

Separate abstracts were prepared for the three included sections. (MOW)

*For abstracts of individual sections see: 1831, 1850, and 1905.*

**1905** (GULF-GA-A-12690, pp 5-64) DOUBLET II. 15 Sep 1973.

In controlled thermonuclear research program.

Characteristic data are given for Doublet discharges with toroidal field 8.5 kG and a filling density of $5 \times 10^{13}$ cm$^{-3}$. The plasma current distribution, conductivity temperature, and stability are described for the discharges. MHD equilibrium calculations are described along with a Thomson scattering experiment. A soft x-ray energy spectrometer to determine plasma electron temperatures is described. (MOW)

**1906** (LA-5403-MS) THERMONUCLEAR BURN CHARACTERISTICS OF COMPRESSED DEUTERIUM–TRITIUM MICROSPHERES. Fraley, G. S.; Linnebur, E. J.; Mason, R. J.; Morse, R. L. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1973. Contract W-7405-eng-36. 20p. Dep. NTIS $4.00.

The phenomenology of thermonuclear burn in deuterium–tritium microspheres at high densities is described, and numerical results characterizing the burn for a broad range of initial conditions are given. The fractional burnup, bootstrap-heating, and depletion of the DT fuel, its expansive disassembly, and thermonuclear ignition by propagating burn from central hot-spots in the microspheres are discussed. Extensive numerical results from a 3-T Lagrangian simulation code are presented. The yields $Y_0$ from uniform 10, 1, and 0.1 μg microspheres with densities $\rho = 1$ to $4 \times 10^4$ g/cm$^3$ and temperatures $T_e = T_i = 1.8$ to 100 keV are given. It is shown that $Y_0 \sim \rho^{1/2}$ for spheres of fixed mass m. The gain-factor $G_0 \equiv Y_0/mI_0$ ($I_0$ is the internal energy) is shown to measure burn efficiency in uniform microspheres. More than a four-fold increment in the gain factor is shown to derive from apportionment of the internal energy in a central hot-spot. The limiting effects of electron degeneracy on the gain factor are outlined. As a guideline, the experimental observation of $10^{13}$ neutrons/kJ of input laser energy is established as proof of good absorption; $10^{15}$/kJ will imply yields exceeding break even. (auth)

**1907** (LA-5411-MS) SENSITIVITY OF FUSION REACTOR AVERAGE CROSS SECTIONS TO THERMAL BROADENING OF THE 14-MeV NEUTRON PEAK. Muir, D. W. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1973. Contract W-7405-eng-36. 4p. Dep. NTIS $4.00.

Ion motion in a deuterium–tritium thermonuclear plasma can cause significant broadening of the 14-MeV peak in the fusion neutron energy spectrum. The shape of the peak is shown to be nearly Gaussian; the full width at half maximum $FW_{DT}$ being related to the plasma thermal energy kT by the relation $FW_{DT} = 5.59\sqrt{kT}$, where both $FW_{DT}$ and kT are expressed in MeV. Numerical examples related to fusion reactor technology illustrate the sensitivity of spectrum-averaged cross sections to the plasma temperature. (auth)

**1908** (ORNL-TM-4342) ORMAK-F/BX FACILITY: PRELIMINARY CONSIDERATIONS. Roberts, M. (Oak Ridge National Lab., Tenn. (USA)). Oct 1973. Contract W-7405-eng-26. 25p. Dep. NTIS $3.25.

In view of the anticipated needs of the U. S. CTR program in the late 1970's, consideration is being given to a large, flexible tokamak facility. This facility would be used first for experiments with H plasma to demonstrate the scientific feasibility of fusion in an injection-heated tokamak. Then, parts of the device would be modified as necessary, and planned shielding and containment features would be added to permit D–T burning experiments. A 10-manyear conceptual design study of such a facility is to be accomplished in FY-1974 by scientists and engineers at ORNL. The project is called ORMAK-F/BX for Oak Ridge Tokamak Feasibility and Burning Experiments. The initial estimates of system parameters, the questions to be addressed, and the organization for the study are described. (auth)

**1909** (ORNL-TM-4353) NUCLEAR PERFORMANCE OF VANADIUM AS A STRUCTURAL MATERIAL IN FUSION REACTOR BLANKETS. Steiner, D. (Oak Ridge National Lab., Tenn. (USA)). Oct 1973. Contract W-7405-eng-26. 36p. Dep. NTIS $4.00.

The nuclear performance of vanadium as a structural material in a deuterium–tritium fusion reactor is discussed. For comparison, calculations are also presented for niobium. The areas considered include: (1) tritium breeding; (2) nuclear heating; (3) radiation effects relating to material damage; and (4) neutron-induced activity. It is concluded that: (1) the tritium breeding characteristics of vanadium are somewhat superior to those of niobium; (2) nuclear heating in the first wall of the blanket will be substantially lower with vanadium than with niobium; (3) helium and hydrogen production in the first wall will be significantly greater with vanadium than with niobium; and (4) vanadium will exhibit an afterheat and biological hazard several orders of magnitude lower than that of niobium for times-after-shutdown of ~ 100 days and greater. (auth)

**1910** (ORNL-tr-2727) EROSION, GAS TRAPPING, AND REEMISSION AT THE FIRST WALL OF A FUSION REACTOR. Scherzer, B. M. U. (Max-Planck-Institut fuer Plasmaphysik, Garching/Munich (F. R. Germany)). Mar 1972. Translated from IPP-9/9. 24p. Dep. NTIS $3.25.

A survey of the literature up to the end of 1971 was made on sputtering, gas trapping, and reemission of hydrogen and helium in metals. The purpose of the work was to collect relevant data needed for an assessment of erosion, pumping, and emission of impurities of the first wall of a fusion reactor and to check for serious gaps. (auth)

**1911** DYNAMICS OF THE DPF AS DETERMINED FROM AN ANALYSIS OF LASER SCATTERING SPECTRA. Downing, J. N. Jr. Houston, TX; Univ. of Houston (1973). 122p. University Microfilms Order No. 73-22,900.

Thesis (Ph. D.).

Time resolved scattering spectra were observed from a dense plasma focus (DPF) illuminated by a pulse of laser light, for two axial positions, 0.6 cm and 1.3 cm from the face of the center electrode. Scattering was observable from 10 nsec prior to the arrival of the collapse on axis until the visible light bremsstrahlung fell below the background illumination of the plasma sheath (~50 nsec). The frequency spectrum is markedly asymmetric about the laser frequency, a feature which is inconsistent with spectral expectations based on thermal particle distributions even if particle drifts or wave excitations are included. A model is postulated which attributes the asymmetry to a non-isotropic velocity distribution and to a lateral displacement of the scattering region from the central axis of the focus. Analysis based on this model yields radial collapse velocity, density, and ion temperatures. Noteworthy features are the absence of radial bounce and indications of axial jetting with ~$10^8$ cm/sec implied axial velocities. (Diss. Abstr. Int., B)

**1912** PLASMA OPERATION OF ALCATOR AT LOW MAGNETIC FIELDS. Ascoli-Bartoli, U.; Blanken, R.; Brossier, P.; Coppi, B.; Halverson, W.; Hugenholtz, A.; Lidsky, L.; Montgomery, B.; Ornstein, L.; Parker, R. (Massachusetts Inst. of Tech., Cambridge). (1973). vp.

From third international symposium on toroidal plasma confinement; Garching, Germany (26 Mar 1973).

Initial plasma operation was achieved with plasma currents up to 50 kA, limiter radius of 10 cm, and toroidal magnetic fields of about 10 kG. The ratio of plasma radius to the copper shell radius is about 0.8. The major radius is 54 cm. The toroidal equilibrium is maintained by a properly programmed vertical field supplementing the effects of the copper shell. The vertical field is excited by the outer compensation coils which are part of the air core transformer. The optimal value of this vertical field was found to be about 150 G per 50 kA. In this initial mode of operation two condenser banks are used to excite the air core transformer system corresponding to a magnetic flux of about 0.15 V sec; the plasma current pulse is limited to about 45 msec maximum duration. After breakdown and plasma formation the measured loop voltage is typically about 1 V/m. Average plasma densities as measured with a 4 mm interferometer are in the range of 3 to $6 \times 10^{13}$ $cm^{-3}$ reaching a maximum when the plasma current goes through maximum. Filling pressures of 0.5 to $1 \times 10^{-4}$ torr have been used; the base pressure as yet amounts to $4 \times 10^{-7}$ torr. During early operation the plasma behavior was still dominated by impurity influx. Image currents in the copper shell are measured to decay as the programmed vertical field begins to provide for the equilibrium during the prolonged discharge pulse. Experimental data are recorded on a 64-channel magnetic drum system (band width 0.5 MHz). (GE)

**1913** INTERPRETATION OF MAGNETIC DISTURBANCES OBSERVED IN TOKAMAKS. Rugherford, P. H. (Princeton Univ., NJ). (1973). vp.

From third international symposium on toroidal plasma confinement; Garching, Germany (26 Mar 1973).

An interpretation of the m = 2 to 4 kink-like perturbations in the constant current phase as resistive tearing modes is supported by linear stability criteria evaluated for the equilibrium current profiles typical of present tokamaks. It is shown that the mode amplitudes, and their long-time integrity, may be explained by nonlinear restraints on tearing-mode growth: nonlinear eddy currents arise near the singular surface, producing $j \times B$ forces which replace the inertia in opposing the vortex-flow associated with the tearing mode. (GE)

## Wave Phenomena

*Refer also to abstract 1802.*

**1914** (JINR-P9-6951) EXCITATION OF ACOUSTIC WAVES BY ION-SOUND TURBULENCE. Abdulloev, Kh. O.; Khakimov, F. Kh.; Makhan'kov, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1973. 22p. (In Russian). Dep. NTIS (U. S. Sales Only) $3.25.

The instability of acoustic oscillations of frequency $\omega \ll \nu_e$, $\nu_i$ in dense completely ionized plasma is considered where ion-sound turbulence is developed. At the level of turbulence for u = w/nT, and exceeds the threshold value $u_{thr.}$, there appear unstable branches of acoustic oscillations in the region $\omega < \nu_e$, $\nu_i$. The instability increments and the threshold value are found. (auth)

**1915** NONLINEAR INSTABILITY OF HARMONIC CYCLOTRONIC (BERNSTEIN) WAVES. Martinov, N. K. (Univ., Sofia). Compt. Rend. Acad. Bulg. Sci.; 26: No. 4, 455-458(1973).

The instability of harmonic cyclotron waves in an electron plasma with a nonlinear Landau scattering of the outer oscillating electric field is studied. In this case the spectra, and especially the increment or decrement of the Bernstein waves, become essential functions of the amplitude of the applied outer field. The problem is studied by means of the elaborated formalism through the introduction of suitable dynamic variables and Hamiltonian for the plasma-field system. (MCW)

**1916** PHASE EFFECTS IN NONLINEAR WAVE-WAVE INTERACTIONS. Fisher, R. K.; Hirshfield, J. L. (Yale Univ., New Haven). Phys. Fluids; 16: No. 4, 567-569(Apr 1973).

An attempt is made to clarify the differences in the nonlinear plasma interaction of two fixed-phase wavepackets from that of two random-phase packets and present a simple interpretation which is in agreement with the available experimental results. (auth)

**1917** COLLISION-FREE SHOCK WAVES. Niu, K. (Tokyo Inst. of Tech.). pp 3-24 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921-.

Theoretical treatments of collision-free shock waves in a plasma are reviewed. The dispersion does not dissipate in collisional shocks, but plays an essential role in the formation of shock waves in a collision-free plasma. A solution of a solitary wave is derived for cold collision-free plasma flow along a magnetic field. This solution is unstable because of perturbations. Instead of a solitary wave, a solution with a quasi-shock wave can be derived if one takes the thermal effect into account. Among collision-free shock waves, electrostatic waves are most easily analyzed. In a steady frame, a solution of a laminar quasi-shock is derived for isothermal high-temperature electrons and two-cold-beam ions. This steady solution is unstable too. Time-dependent numerical solutions with finite-amplitude electrostatic waves based on the Vlasov-Maxwell equations show the formation of quasi-shock-like waves. In the case of collision-free shock waves in a magnetic field, there are various types of instabilities that cause the onset of shock waves. Then it is necessary to show the buildup of the unstable perturbations against nonlinear turbulence through wave-particle or wave-wave interactions. Usually diffusion-type equations derived through quasi-linear approximations of the Vlasov-Maxwell equations are used for these processes. On the other hand, there is also a test for deriving shock-like solutions from the Vlasov equations themselves without change to the parabolic type for a collision-free plasma flow perpendicular to a magnetic field. Numerical calculations show that the electric potential forms a sharp peak in the flow where the ion has a double-humped velocity distribution. (auth)

**1918** INVESTIGATION OF ION WAVES. Dawson, J. M. (Princeton Univ., NJ); Kruer, W. L.; Rosen, B. Contract AT-(30-1)-1238. pp 47-61 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921-.

Investigations of (1) the nonlinear behavior of ion waves, (2) the growth and saturation of the ion-acoustic instability, and (3) the interaction of holes in the electron phase space with ions on a one-dimensional numerical plasma model are reported. For the nonlinear behavior of ion waves a number of different effects were examined and analyzed. The steepening and breaking of an initial sinusoidal wave were considered. It was found that for perturbations such as $\delta n/n \simeq k^2 \lambda_D^2$ strong harmonic generation occurs. For sufficiently large amplitudes, the waves break and ion trapping takes place. The precise amplitude at which this occurs depends strongly on the ratio of the ion temperature to the electron temperature. A typical value for a temperature ratio of 0.03 is $\delta n/n = 0.25$. The growth of the ion-acoustic instability was found to be in agreement with linear theory. Its saturation level was found to be determined by the energy released when electrons became trapped by the ion waves and a simple theory for it is given. Finally, it was found that holes in the electron phase space can interact strongly with ions and that there can be an appreciable anomalous resistance associated with them. (auth)

**1919** WEAK NONLINEAR MAGNETO-ACOUSTIC WAVES IN AN INHOMOGENEOUS PLASMA. Kakutani, T. (Kyoto Univ.). pp 63-66 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921-.

It was established earlier that the one-dimensional plane magneto-acoustic waves with small but finite amplitude in a cold collisionless plasma can be described by the Korteweg-de Vries equation, provided that the undisturbed state is homogeneous. Here, the effect of inhomogeneity in plasma density and transverse magnetic field on the propagation of such waves is studied theoretically. (MOW)

**1920** TURBULENT PROCESS IN SHOCK WAVES. Yamanaka, C.; Nakai, S.; Mizui, J.; Matoba, M.; Ueda, K. (Osaka Univ.). pp 67-81 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921-.

The dissipation process in collisionless plasma is attributed to the nonlinear phenomena caused by the instabilities of plasma. Such a collisionless dissipation allows the existence of shock waves in a rarefied collision-free flow. Results of an experimental study of the nature of the collisionless shock front in magnetized and nonmagnetized plasmas are presented here. (auth)

**1921** INTERACTION OF A STRONG SHOCK WAVE WITH ELECTROMAGNETIC FIELD. Mucha, Z. (Inst. of Fundamental Technical Research, Warsaw). pp 131-144 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

The interaction between a strong shock wave and the magnetic field generated by the shock moving in an electric field between electrodes is studied experimentally and theoretically. The radiation from the plasma and the schlieren picture of the flow were registered by a high-speed streak camera. The data are described. (MOW)

**1922** STRUCTURE OF ALMOST COLLISIONLESS SHOCKS IN A MAGNETOPLASMA AND THE ION-ACOUSTIC INSTABILITY. Woods, L. C. (Oxford Univ.). pp 145-151 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

A phenomenological treatment of the anomalous resistivity resulting from the ion-acoustic instability is described. The effective "collision" frequency occurring in the resistivity is taken to be the maximum growth rate predicted by linear theory for the ion-acoustic instability. This resistivity is used to calculate shock structures for shocks propagating perpendicularly to magnetic fields, and it is found that the shock thickness and downstream temperature ratio $T_i/T_e$ agree well with some experimental results. It is concluded that ion-acoustic instability does play an important role in determining collisionless shock wave structure. (auth)

**1923** EXPERIMENTS OF SHOCK WAVES IN A FULLY IONIZED PLASMA FLOW. Adati, K.; Asano, N.; Fujita, J.; Hamada, S.; Muraoka, K.; Shimamura, S.; Taniuti, T. (Nagoya Univ., Japan). pp 153-160 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

Formation and propagation of a shock wave in a nonstationary flow of fully ionized, collision-dominated plasma are examined. (auth)

**1924** SHOCK WAVES WITHIN THE TWO-FLUID MODEL IN THE PRESENCE OF THE MAGNETIC FIELD. Deutsch, R. V. (Polytechnical Inst., Iasi). pp 167-188 of Dynamics of Ionized Gases. Lighthill, M. J. (ed.). New York; John Wiley and Sons, Inc. (1973).

From international symposium on dynamics of ionized gases; Tokyo, Japan (13 Sep 1971). See CONF-710921–.

Starting from conservation laws and from Maxwell equations applied to a two-component plasma in the magnetic field, conclusions are obtained for jumps of physical magnitudes irrespective of the intensity of such jumps. The dependence of the Mach number on the intensity of the shock wave, on the strength of the magnetic field, and on the wave orientation with respect to the magnetic field is determined. By analyzing the hodographs of the propagation velocity of shock waves represented as a function of the waves' direction with respect to the magnetic field, one can establish the existence of two domains where all three shock waves appear (those analogous to the Alfvén waves too), and of some domains where only a slow wave will appear. The dependence of the limits of these domains on both the intensity of the magnetic field and the intensity of shock waves is analyzed. The structure of weak shock waves is analyzed using the two-fluid model, considering also the dissipative terms and averaging with respect to the oscillations. The density jump is considered as a small parameter, the function of which is expressed as the jump of the other physical magnitudes in an approximation up to the second order and the width of the shock wave is calculated. It is shown that the electric field inside the shock wave leads to the excitation of oscillations with frequency close to the frequencies of the linear oscillations of a plasma found in the magnetic field and which superpose inside the shock wave front. (auth)

**1925** COLLISIONLESS DAMPING OF ION ACOUSTIC WAVES. Jensen, V. O.; Petersen, P. I. (Danish Atomic Energy Commission Research Establishment, Risoe). Phys. Lett.; 45A: No. 4, 293-294 (8 Oct 1973).

Exact theoretical treatments show that the damping of ion acoustic waves in collisionless plasmas does not vanish when the derivative of the undisturbed distribution function at the phase velocity equals zero. (auth)

**1926** WAVE PROPAGATION IN MAGNETOACTIVE PLASMAS. Abrol, P. S.; Varma, N. L. (Univ. of Rajasthan, Jaipur, India). Physica; 67: No. 2, 389-399 (15 Jul 1973).

The propagation of electromagnetic waves in an unbounded, fully ionized, collisional plasma embedded in a uniform, steady magnetic field is investigated by means of the Gross–Krook collision model. The dispersion relation is derived and examined for the wave propagation along the magnetic field, considering an anisotropic velocity distribution of the electrons. On account of anisotropy additional significant terms are obtained in both the real and imaginary parts of the dispersion relation. Anisotropy tending to zero was also considered. It is noted that the presence of a magnetic field tends to stabilize the ordinary wave and destabilizes the extraordinary wave but it does not affect the longitudinal waves. The damping due to electron-ion collisions is heavier than that due to electron-electron collisions. However, collisions as well as certain anisotropic velocity distributions of electrons both have stabilizing effects on the electromagnetic waves. (auth)

**1927** LAUNCHED WAVES ON A BEAM-PLASMA SYSTEM. DeNeef, C.P.; Malmberg, J.H.; O'Neil, T.M. (Physics Department, University of California at San Diego, La Jolla, California, 92037). Phys. Rev. Lett. 30: No. 21, 1032-1035 (21 May 1973).

An unstable launched wave on a low-density, cold-electron-beam-plasma system grows and traps the beam electrons. Test waves at neighboring unstable frequencies are observed to stop growing where the beam is trapped and to exhibit amplitude oscillations that are coherent with the amplitude oscillations of the main wave. The behavior of the test wave is calculated by regarding it as a slow modulation of the main wave's amplitude and phase. (auth)

**1928** ELECTRON-BEAM EXCITATION OF LOW-FREQUENCY WAVES IN A HOT PLASMA CONFINED IN A MIRROR MACHINE. Kovpik, O.F.; Kornilov, E.A.; Kolyada, Y.E.; Shapiro, V.D.; Shevchenko, V.I. Sov. Phys.-Tech. Phys. 17: No. 10, 1641-1643 (Apr 1973).

The excitation of waves by an electron beam injected into a hot plasma ($v_b < v_{Te}$) in an open magnetic trap is analyzed. The electron beam excites ion-acoustic waves, is scattered by them, and is trapped. Trapping of the beam produces an electrostatic potential which in turn excites centrifugal instabilities. Effective ion heating is observed. (auth)

**1929** ABSORPTION NEAR THE LOWER HYBRID RESONANCE. Dnestrovskii, Y.N.; Kostomarov, D.P.; Pereverzev, G.V. (M. V. Lomonosov Moscow State University). Sov. Phys.-Tech. Phys. 17: No. 10, 1637-1640 (Apr 1973).

The absorption of waves by an inhomogeneous magnetized plasma is analyzed in the frequency range from the ion cyclotron frequency to the lower hybrid resonance frequency. It is assumed that a cold collisionless plasma is contained in a ideally conducting cylindrical chamber and that oscillations are excited by an externally supplied azimuthal current. Numerical methods are used to investigate the dependence of the Q and radiation resistance of the current loop on the current frequency, plasma density, longitudinal magnetic field, and dimensions of the system. Also solved is the problem of the natural modes of the plasma volume near which the resonance absorption of plasma energy is observed. The results of the calculations are compared with existing experimental data. (auth)

**1930** WAVES IN A MAGNETOPLASMA WITH AN ISOLATED TRANSVERSE ION VELOCITY COMPONENT. Machabeli, G.Z.; Tskhakaya, D.D. (Physics Institute, Academy of Sciences of the Georgian SSR, Tbilisi). Sov. Phys.-Tech. Phys. 17: No. 10, 1624-1626 (Apr 1973).

Electron heating is examined for the ion plasma branch. It is found that waves oblique to the magnetic field can be amplified. A difference from a previous study is the finding that only the two-stream instability occurs for waves propagating across the magnetic field. (auth)

**1931** NON-LINEAR STABILITY OF IONIZATION WAVES. Kogan, E. Ya.; Fisun, O. I. (Kiev State Univ.). Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 7, 1104-1108 (Jul 1973). (In Russian).

Three-wave interactions of ionization waves is studied in the absence of a magnetic field. It is shown that the laws of conservation of energy and momentum can be realized for the wave class under consideration. The increment of decay instability is determined. (auth)

**1932** ELECTROSTATIC SURFACE MODES OF A TOROIDAL PLASMA. Talmadge, S.; Marshall, T.C.; Schlesinger, S.P. (Columbia University, New York, New York 10027). Phys. Fluids 16: No. 7, 1171-1173 (July 1973).

A theoretical study has been made of the surface wave resonances of an electrostatic wave propagating on a plasma torus. These results are in satisfactory agreement with an experiment. (auth)

**1933** ELECTROSTATIC WAVES IN A NONUNIFORM PLASMA. Peratt, A.L. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Fluids 16: No. 7, 1032-1041 (July 1973).

Approximate expressions describing the Tonks-Dattner and Buchsbaum-Hasegawa resonances (at the second electron cyclotron harmonic) in a warm nonuniform plasma are derived by means of a fairly easy analytic continuation technique. Connection formulas are developed for third-order electric field differential equations derived from kinetic theories and show the coupling of slow and fast waves in the vicinity of a linear turning point. The relatively simple field expressions predict traveling longitudinal waves possessing outwardly directed phase velocities. Internal plasma fields appreciably larger than the excitation field are found when the density nonuniformity supports even mode resonances. The field equations and expressions for the associated impedance variation are compared to numerical integration solutions and show striking similarity to experimental observations. (auth)

1934 DIRECT NONLINEAR COUPLING OF ELECTROMAGNETIC WAVES AND ELECTROSTATIC WAVES IN A PLASMA: EXPERIMENT. Phelps, D.; Van Hoven, G.; Rynn, N. (Department of Physics, University of California, Irvine, California 92664). Phys. Fluids 16: No. 7, 1078-1086 (July 1973).

Observations of direct nonlinear coupling between electromagnetic waves and electrostatic waves in the bulk volume of a plasma are reported and compared with the predictions of an accompanying physical theory. The experimental configuration consists of a cylindrical resonant cavity partially filled with a coaxial Q-machine plasma column. Experimental verification of the predicted interaction resonances is presented. The finite interaction length defined by the cavity modifies the theoretical wave number selection rule, imparting a "lineshape" to the resonance which is consistent with observations. Two of the three interacting waves are externally excited and their interaction causes a third wave to grow with distance. The direction of growth depends upon the resonance conditions and choice of excitation, while the rate of growth depends upon the pump level, coupling strength, and linear wave damping. Indirect measurements of the mode power levels are presented which verify in magnitude the theoretically predicted coupling. (auth)

1935 PARAMETRIC EXCITATION OF SURFACE WAVES IN AN INHOMOGENEOUS MAGNETIZED PLASMA. Aliev, Y.M.; Gradov, O.M. (M. V. Lomonosov Moscow State University). Sov. Phys.-Tech. Phys. 17: No. 11, 1906-1907 (May 1973).

The stability of an inhomogeneous semiinfinite plasma in a high-frequency electric field and a constant magnetic field is investigated. Under parametric resonance conditions the plasma is unstable against longitudinal surface waves with phase velocity greater than the thermal velocity. Expressions for the growth rates are derived. The threshold values of the external field are obtained by setting the growth rates equal to zero. (auth)

1936 ABSORPTION OF ELECTROMAGNETIC WAVES AT PARAMETRIC RESONANCES IN A MAGNETOACTIVE PLASMA. Golovanivskii, K.S.; Blancho, X.C. (Patrice Lumumba Peoples Friendship University, Moscow). Sov. Phys.-Tech. Phys. 17: No. 11, 1895-1896 (May 1973).

Propagation of EM waves at powers 2 to 20W in a waveguide partially filled with a magnetoactive plasma was investigated experimentally in the range of magnetic fields from zero up to three times the cyclotron resonance field. In investigation of parametric absorption, with intense waves a strong attenuation is observed at values of the magnetic field equal to $3/2$, 2, and $5/2$ the cyclotron resonance value. (LMT)

# PHYSICS (RADIATION AND SHIELDING)

## Radiation Physics

*Refer also to abstracts 490, 659, 660, 1020, and 1095.*

**1937** (ITJ-17) MONTE-CARLO PROGRAMS FOR THE CALCULATION OF GAMMA-PHOTONS TRANSPORT THROUGH INHOMOGENEOUS MEDIA. Umiastowski, K. (Akademia Gorniczo-Hutnicza, Krakow (Poland). Instytut Techniki Jadrowej). Dec 1972. 59p. Dep. NTIS (U. S. Sales Only) $5.00.

The algorithms and the programs for the Monte-Carlo calculation of photon transport through inhomogeneous media are presented. Discussed inhomogeneous medium consists of a continuous matrix in which spherically shaped grains of inhomogeneities are randomly distributed. The first program RANDOM calculates a set of photon histories which is recorded on the magnetic tape. These sets of photon histories constitute an input data for other programs calculating the different characteristics of radiation. (auth)

**1938** (ORNL-TM-4368) TRANSPORT OF RESONANCE RADIATION IN ARGON. Talmage, J. E. Jr.; Hurst, G. S.; Payne, M. G.; Wagner, E. B. (Oak Ridge National Lab., Tenn.). Oct 1973. Contract W-7405-eng-26. 148p. Dep. NTIS $9.50.

Thesis. Submitted by J. E. Talmage, Jr. to Univ. of Kentucky, Lexington.

The transport of resonance radiation in argon has been studied over a wide pressure range (0.002 to 600 torr). A line source of argon $^1P_1$ states was produced by a collimated, pulsed beam of protons traveling down the axis of a cylinder filled with a pure grade of argon. The time dependence of escaping resonance radiation was examined. The geometrical arrangement and initial conditions are simple, and a detailed comparison can be made between theory and experiment. The basic assumptions of resonance transport theory have been examined for the $^1P_1$ state in argon, and it is found that revisions are required at lower pressures where collisions between excited atoms and ground state atoms are infrequent. Comparison between this experiment and theory shows a discrepancy of as much as a factor of three. A newer theory, which allows for coherent re-emission (in the rest frame of the atom) when no collision occurs during the lifetime of an excited state, is examined and found to be in reasonable agreement with the data. At higher pressures, the two transport theories give the same results and are in agreement with this experiment to within 10%. The role of the transport of resonance radiation in the pathways taken by the energy deposited by the proton beam is examined. Various effects are observed, and tentative explanations are presented for the behavior of the radiation escaping from the $^1P_1$ state. An estimate is made on the energy escaping near 1048 Å and in the continuum around 1250 Å and is found to be consistent with the model of Hurst and Thonnard. (auth)

**1939** (PRNC-164) GAS STOPPING POWER MEASUREMENTS FOR ALPHA PARTICLES. Ortiz, E.; Arenas Rosillo, G. M. (Puerto Rico Nuclear Center, Mayaguez). May 1973. Contract AT(40-1)-1833. 80p. Dep. NTIS $6.00.

Thesis. Submitted by G. M. Arenas Rosillo to Puerto Rico Univ., Mayaguez.

A method has been developed to measure the stopping powers of gases for alpha particles using a Si semiconductor detector mounted opposite a natural $^{241}$Am alpha source in a gas chamber and a 1024-channel data acquisition system. By varying the gas pressure and taking an energy loss measurement at each pressure, the stopping powers and molecular stopping cross sections were calculated; also, range-energy relationships were measured simultaneously. Experimental data are given for air, $N_2$, $O_2$, $CO_2$, $N_2O$, A, Kr, Freon 14, $CH_4$, $C_2H_4$, $C_2H_6$, and $C_3H_8$ for alpha particles in the range 0.3 to 5.0 MeV alpha energy. The estimated probable error in the cross sections ranges from approximately 4 to 5% at the highest energies to approximately 9 to 10% at the lowest energies. (auth)

**1940** DEVELOPMENT AND APPLICATION OF A COUPLED MONTE CARLO NEUTRON–PHOTON TRANSPORT CODE. Robinson, P. A. Davis, CA; Univ. of California (1972). 80p. University Microfilms Order No. 73-19,106.

Thesis (Ph. D.).

A three-dimensional, temperature-dependent Monte Carlo photon transport code, HUCK FINN, and a three-dimensional coupled neutron–photon transport code, POGO, were developed and used to study the generation and effect of a photon flux in a controlled thermonuclear reactor (CTR). Potentially inverse Compton scattering, wherein a photon gains energy as a result of scattering from a moving electron within the plasma, provides a mechanism for a photon flux to rob energy from the plasma, thereby affecting the operation of the CTR. Photon fluxes are generated within the CTR by reactions in plasma itself and inelastic neutron events in the blanket surrounding the plasma. The POGO code was used to calculate the photon flux incident on a CTR plasma, and the code HUCK FINN was used to calculate the energy robbed from the plasma via inverse Compton events. These calculations show that photon fluxes generated in the blanket and in the plasma do not significantly affect the operation of currently anticipated CTR's. (Diss. Abstr. Int., B)

**1941** MULTIPLE ELECTRON SCATTERING THROUGH A SLAB. Jacob, J. H. (AVCO Corp., Everett, MA). Phys. Rev., A; 8: No. 1, 226-235(Jul 1973).

The transport equation for electron scattering through plane parallel targets has been solved by expanding the electron distribution function into spherical harmonics. The electron energy is assumed to be constant. No simplifying assumptions have been made concerning the scattering cross sections. In fact, a simple technique has been found for accurately determining the screening angle which plays an important role in multiple scattering. For small angles (≤10°) and thin targets, the emerging electron distribution agrees well with earlier theories. However, for larger angles the present theory predicts a greater probability of scattering than earlier theories. For thin targets it is well known that the earlier theories merge with the single-scattering distribution function at large angles. This difference at large angles between the present and earlier theories implies that the electron distribution predicted by the present calculations will not merge with the single-scattering distribution. For thick targets, as one would expect, the earlier theories are poor approximations of the emergent electron distribution function for all angles. (auth)

**1942** DIFFRACTION RADIATION FROM A CHARGED PARTICLE MOVING THROUGH A PENETRABLE SPHERE. Pogorzelski, R.; Yeh, C. (Univ. of California, Los Angeles). Phys. Rev., A; 8: No. 1, 137-144(Jul 1973).

The formal exact solution to the problem of the radiation of a charged particle traveling with a constant velocity through a dielectric sphere is obtained. The electromagnetic field may be expressed in terms of an infinite number of spherical normal modes. It is found that radiation may be emitted for arbitrarily small particle velocities. For larger spheres (i.e., $ka \gg 1$ when k is the wave number and a is the radius of the sphere) the radiated field is predominantly Čerenkov-type radiation when the velocity of the particle is above the Čerenkov threshold velocity. For small spheres ($ka \gg 1$) and low particle velocities the radiation is shown to be mainly of transition type. Numerical results are presented to illustrate the behavior of the spectra of the various lower-order radiative modes as the velocity of the particle is varied. (auth)

**1943** DENSITY EFFECT IN dE/dx OF FAST CHARGED PARTICLES TRAVERSING VARIOUS BIOLOGICAL MATERIALS. Kim, Y. S. (Ohio State Univ., Columbus). Radiat. Res.; 56: No. 1, 21-27(Oct 1973).

The density correction in the stopping power of fast charged particles in a number of biological materials (muscle, bone, ox lens, cat liver, standard man, rat fat, etc.) is given. The correction is based on an empirical procedure developed by Sternheimer and Peierls for nonbiological materials. Density correction parameters valid for any charged particles are given and some numerical examples are given for electrons in the energy range of 0.1 MeV to 10 GeV. (auth)

**1944** MONTE CARLO CALCULATION OF ELECTRON EMISSION FROM ALUMINUM AND LEAD EXPOSED TO 1.25 MeV GAMMA RAYS. Minato, S. (Government Industrial Research Inst., Nagoya, Japan). Radiat. Res.; 56: No. 1, 1-7(Oct 1973).

Monte Carlo methods were applied to the problem of gamma ray induced electron transport. The energy spectrum, the angular distribution and the efficiency of electrons emitted from aluminum and lead exposed to 1.25 MeV gamma rays were calculated and compared to experimental data obtained by using $^{60}$Co source. Only Compton scattering and photoelectric interactions were considered and the effect of delta rays was ignored. Although the agreement between Monte Carlo and measured results was generally good, the considerable difference between them was showed for the emission efficiency in backward direction. (auth)

**1945** HEAVY-PARTICLE RADIOGRAPHY. Benton, E. V. (Univ. of San Francisco); Henke, R. P.; Tobias, C. A. Science; 182: No. 4111, 474-476(2 Nov 1973).

Energetic heavy particles from an accelerator may be used to produce radiographs with high contrast and high depth resolution. Small differences in the stopping power of objects can be detected and permanently recorded by using stacks of plastic track detectors. This method should aid in the diagnosis of soft-tissue abnormalities, including some tumors, and make possible quantitative reconstruction of the internal density structure of objects. (auth)

**1946** EFFECTS OF MULTIPLE SCATTERING ON PROTON BEAMS IN RADIOTHERAPY. Carlsson, J.; Rosander, K. (Uppsala Univ.). Phys. Med. Biol.; 18: No. 5, 633-640(Sep 1973).

A method for the numerical calculation of flux density distributions at various depths of penetration of accelerated light ions in arbitrary media is presented. The method is applied to the calculation of the effect of multiple scattering of a narrow 185 MeV proton beam. The agreement between calculated and experimentally obtained flux density distributions is reasonably good. (auth)

**1947** DOSE CONVERSION FACTORS AT THE CALIBRATION BEAM ENERGY. Valley, J. F.; Lerch, P. (Univ., Lausanne, Switzerland). Phys. Med. Biol.; 18: No. 5, 744-746(Sep 1973).

The dose-to-water of x rays from calibrated cavity measurements has been previously calculated for energies from $^{137}$Cs to 35 MeV (Schutz, R. J. Phys. Med. Biol. 15, 563, 1970). Values of the corrections to be applied for energies from $^{137}$Cs to 50 MeV x rays have also been given by others (SRAD, Phys. Med. Biol. 16, 379, 1971). It is now shown that the dose-to-water conversion factors for ionization chamber measurements in water and at an equivalent location in plastic should be equal for the calibration radiation. The previous work showed a difference of 1% between water (0.95) and polystyrene (0.94) conversion factors, which is almost certainly obtained by rounding off errors. (UK)

**1948** PROTOCOLS FOR ELECTRON DOSIMETRY. De Almeida, C. E.; Almond, P. R. (Univ. of Texas, Houston). Phys. Med. Biol.; 18: No. 5, 737-740(Sep 1973).

Brief comments are made on the standardization of electron dose calibration procedures in relation to the recommendations made by the American Association of Physicists in Medicine 1966, The Mordic Association of Clinical Physics 1971, The Hospital Physicists Association 1971, and the ICRU 1972. Errors arising from depth-dose curves are discussed, together with those arising from the specification of beam energy using the half-value depth in water. It is recommended that the depth-dose curves (especially in the region of dose maximum) be measured for each machine, the depth of calibration be chosen as close to the maximum as possible, and the energy be determined from the established range-energy relationships. (UK)

**1949** CONTRIBUTION OF GALACTIC COSMIC RAYS TO THE ATMOSPHERIC NEUTRON MAXIMUM DOSE EQUIVALENT AS A FUNCTION OF NEUTRON ENERGY AND ALTITUDE. Merker, M. (Univ. of Pennsylvania, Philadelphia). Health Phys.; 25: No. 5, 524-527(Nov 1973).

The dose arising from cosmic ray neutrons has been re-evaluated using a calculation of atmospheric neutron fluxes that has been shown to agree with recent measurements. It is shown that the contribution by neutrons above 10 MeV to the cosmic-ray atmospheric neutron dose is much greater than generally believed. This is particularly significant in view of the relative lack of radiobiological data for neutrons of these energies. (UK)

**1950** EVALUATION OF THE APPLICABILITY OF THEORY TO THE PROBLEM OF CHARGED-PARTICLE TRANSPORT THROUGH A LAYER. Belyaev, A. A.; Krupman, A. I. At. Energ. (USSR); 35: No. 2, 95-100(Aug 1973). (In Russian).

The Monte Carlo method is used to estimate the physical accuracy of approximate solutions of charged-particle transport equations. Calculated angular, space, and energy distributions of electrons after passage through a layer are compared with similar distributions obtained in the small-angle approximation of multiple-scattering theory. The model error is determined by the accuracy of the interaction cross sections used. The calculations are valid for electrons having an energy of ~50 keV and layer thicknesses corresponding to ~100 elastic collisions. Obtained errors in the magnitudes of spectral characteristics may serve as criteria for estimating the region of applicability of the small-angle approximation in the problem of charged-particle transport through a layer. (MHR)

**1951** CALCULATION OF THE DISTRIBUTION OF MONOENERGETIC MODERATE-ENERGY PROTONS IN OPTICAL MATERIALS. Lalakin, A.V. Sov. J. Opt. Technol. 39: No. 10, 643-644 (Oct 1972).

Expressions for calculating the root-mean-square variance of proton path lengths caused by dispersion of the proton beam and by the fluctuation in ionization losses are derived. (CES)

**1952** DOPPLER SHIFTS WITH GAS BACKINGS: SLOWING DOWN OF IONS IN KRYPTON. Donahue, D.J. (Department of Physics, University of Arizona, Tucson, Arizona 85721). Phys. Rev. C 8: No. 2, 846-847 (Aug 1973).

Doppler shifts of $\gamma$ rays emitted from excited states of nuclei slowing down in krypton gas have been measured. The particular excited states studied were chosen because they have mean lives which are well known. The measured Doppler shifts are used to gain information concerning the slowing-down properties of krypton for the recoiling ions. (auth)

**1953** ENERGY LOSS OF $^{20}$Ne IONS IN ALUMINUM. Shane, K.C.; Seaman, G.G. (Department of Physics, Kansas State University, Manhattan, Kansas 66506). Phys. Rev. B 8: No. 1, 86-89 (1 July 1973).

The energy losses of 19.8– and 18.5–MeV $^{20}$Ne ions in aluminum have been measured by a new technique. The Doppler–shifted energies of $\gamma$ rays from the first excited state of $^{20}$Ne, produced in the $^{12}$C($^{12}$C,$\alpha$) $^{20}$Ne reaction, were used to determine the Ne–ion velocities before and after passing through an aluminum foil. The results are in good agreement with expected energy losses, thus removing a discrepancy in earlier work. (auth)

**1954** ENERGY–LOSS AND STOPPING–POWER MEASUREMENTS BETWEEN 2 AND 10 MeV/amu FOR $^3$He AND $^4$He IN SILICON. Sellers, B.; Hanser, F. A. (Panametrics, Inc., Waltham, Massachusetts 02154); Kelley, J.G. Phys. Rev. B 8: No. 1, 98-102 (1 July 1973).

The energy deposited in a 94.6–μm–thick totally depleted silicon detector by beams of $^3$He and $^4$He ions was measured at incident energies up to 10 MeV/amu. It is assumed that the stopping power of an ion of energy E, mass M, and charge z can be expressed approximately by $S=A[(E/M)+r]^{1-n}$, and the parameters A, n, and r are determined from the energy–loss data. Within the experimental error the results are found to agree with recent theoretical calculations which include a $z^3$ correction. (auth)

**1955** ENERGY–LOSS AND STOPPING–POWER MEASUREMENTS BETWEEN 2 AND 10 MeV / amu FOR $^{12}$C, $^{14}$N, AND $^{16}$O IN SILICON. Kelley, J.G. (Air Force Cambridge Research Laboratories, Bedford, Massachusetts 01730); Sellers, B.; Hanser, F.A. Phys. Rev. B 8: No. 1, 103-106 (1 July 1973).

The energy deposited in a 94.6–μm–thick totally depleted silicon detector by beams of $^{12}$C, $^{14}$N, and $^{16}$O was measured at incident energies up to 10 MeV/amu. Theoretical stopping powers for these ions are derived from best theoretical values for protons and a universal distribution of ion charges as a function of energy. The effect of a recently derived $z^3$ correction is included. This correction is found to improve the fit to the experimental values. (auth)

## Radiation Protection Standards

*Refer also to abstracts 619, 623, 624, 625, 782, 800, and 2324.*

## Radiation Source Calibration and Standardization

**1956** SIMPLE SYSTEMS FOR QUICK ASSESSMENT OF STRENGTH OF RADIOACTIVE SOURCES IN CLINICAL APPLICATIONS. Ramanuja Rao, K. (Inst. of Mathematical Sciences, Madras). Indian J. Radiol.; 26: No. 1, 32-35(Feb 1972).

A simple and quick method for rough assessment of strength of radioactive sources is a constant requirement in a nuclear medicine laboratory. The activities to be measured may vary from a fraction of a microcurie to several tens of millicuries. Three simple systems for assay of gamma emitting isotopes that can be rigged up using nucleonic equipment available from the Electronics Corporation of India (ECIL) are described. They are (1) an optic bench arrangement used with a scintillation probe for the 0.1 to 100 μCi range; (2) a system of GM tubes arranged along the circumference of a cylinder for the 1 to 500 μCi range; and (3) a reentrant ionization chamber system for activities in the range 100 μCi to 100 mCi or more. They do not require sample preparations and measuring twice is less than 5 minutes. These systems are presented with a hope that such information might be of interest to smaller institutions wishing to start nuclear medicine work. (auth)

## Shielding Calculations and Experiments

***Refer also to abstract 2012.***

**1957** MEASUREMENT OF GAMMA-RAY ALBEDOS FROM HIGH-ENERGY PHOTONS INCIDENT UPON COMMON SHIELDING MATERIALS. Hassler, L. A. Charlottesville, VA; Univ. of Virginia (1973). 232p. University Microfilms Order No. 73-24,965.

Thesis (Ph. D.).

The backscattered energy distribution and dose due to high-energy photons normally incident upon semi-infinite slabs of concrete, iron, and lead were measured. Intense gamma-ray beams with average energies of about 6 and 8 MeV were produced by neutron radiative capture in titanium and nickel targets placed in the tangential beam port of the University of Virginia Reactor. The energy distributions were measured with a well collimated NaI spectrometer for scattering angles of 115°, 135°, and 160°. Angularly differential dose albedos were calculated from the dose data obtained with an anthracene dosimetry system for scattering angles between 115° and 165°. The experimental results indicate that the bremsstrahlung production in high-Z materials from secondary electrons introduces high-energy photons into the backscattered spectrum that cause about fifty percent of the backscattered dose. Experimental results were compared with a photon—electron coupled Monte Carlo code, MONTELEC, which includes bremsstrahlung production in the calculational technique. Agreement between the experimental and analytical results are good for lead. For low-Z materials, the experimental results are much lower than those from Monte Carlo calculations. The difference seems to be due to deeply scattered photons having the desired polar angular direction, but not falling into the solid angle defined by the detector. Since analytical techniques account for these photons, there is a fundamental problem in comparing experimental and analytical albedo results for highly penetrating radiation in the geometric configuration used in this experiment. (Diss. Abstr. Int., B)

**1958** SHIELDING OF MANNED SPACE VEHICLES AGAINST GALACTIC COSMIC-RAY PROTONS AND ALPHA PARTICLES. Santoro, R. T.; Alsmiller, R. G. Jr.; Chandler, K. C. (Oak Ridge National Lab., TN). Nucl. Sci. Eng.; 52: No. 1, 124-129(Sep 1973).

Calculated results are presented of the absorbed-dose rates and dose-equivalent rates as a function of depth in tissue when galactic cosmic-ray proton and alpha-particle spectra are isotropically incident on a spherical shell shield with a tissue sphere at its center. Aluminum shield thicknesses of 5 and 20 g $cm^{-2}$ are considered. It is found that the dose rates from incident alpha particles are comparable to those from incident protons, and that for both protons and alpha particles there is a very appreciable contribution to the dose rates from nuclear-reaction products. (auth)

**1959** CALCULATION OF GAMMA-RAY BUILDUP FACTORS INCLUDING THE CONTRIBUTION OF BREMSSTRAHLUNG. Kuspa, J. P.; Tsoulfanidis, N. (Univ. of Missouri, Rolla). Nucl. Sci. Eng.; 52: No. 1, 117-123(Sep 1973).

Buildup factors for gamma rays traversing slab shields have been obtained using the Monte Carlo method. Secondary particles produced inside the shield were taken into account, with special attention given to the contribution of bremsstrahlung which is produced by electrons and positrons. The results indicate that annihilation gamma rays from pair production do increase the buildup factor a little, but that the bremsstrahlung contribution is much more pronounced. The contribution of bremsstrahlung to the dose buildup factor reaches 33% of its total value for 8-MeV gamma rays traversing 5 mean-free-paths of lead. For single-material shields, the results agree well with the experiment. For double-material shields, comparison with experiment is not possible due to the lack of such data. (auth)

# PHYSICS (THEORETICAL)

## General

*Refer also to abstract 452.*

**1960** (CNRS-CPT-73-P-543) INVARIANCE ALGEBRAS AND INTERACTIONS IN NONRELATIVISTIC QUANTUM MECHANICS. Burdet, G.; Perrin, M.; Sorba, P. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). May 1973. 9p. Dep. NTIS (U. S. Sales Only) $3.00.

The extended derived Galilean algebra $G'$ is extended by a SU(1,1) algebra and the semi-direct sum $G'$ SU(1,1) isomorphic to extended Schroedinger algebra is constructed. The study is not limited to free particle systems. It is shown that: a class of Hamiltonians can be associated with each one-dimensional nonconjugate subalgebra of the Lie algebra, the Hamiltonians contain some external fields which belong to the realized derivations acting effectively on the germ, they are submitted to constraints imposed by the inclusion of the added algebra. (auth)

**1961** EXTREME RELATIVISTIC LIMIT OF ARBITRARY SPIN WAVE EQUATIONS. Ramanujam, G. A. (Nallamuthu Gounder Mahlingam Coll., Pollachi, India). Int. J. Theor. Phys.; 7: No. 5, 311-318(1973).

The extreme relativistic limit (E-representation) of the wave equation in the Schroedinger form $i\delta\psi/\delta t = H\psi$ describing particles and anti-particles of spin "s" and nonzero rest mass "m" is presented. As the wave function has just the minimum number of $2(2s + 1)$ components, the necessity of avoiding redundant components by auxiliary conditions does not arise. Relevant expressions are given for the infinitesimal generators of the Poincare group and for the operators representing the observables in this representation. (auth)

**1962** SENSITIVE OBSERVABLES OF QUANTUM MECHANICS. Capasso, V.; Fortunato, D.; Selleri, F. (Univ., Bari, Italy). Int. J. Theor. Phys.; 7: No. 5, 319-326(1973).

It is proved that there are quantum mechanical observables which are sensitive to the type of state-vector (first type or second type) describing two correlated physical systems, in the sense that the expectation value of these "sensitive observables" is measurably different in the two cases. The proof centers around Bell's inequality (Physics; 1: 195 (1965)) since it is shown that in quantum mechanics for all state-vectors of the second type (and only for them) sensitive observables exist in the absence of super-selection rules. Experimental verification of the existence of sensitive observables rules out local hidden variables. (auth)

**1963** QUANTIZATION IN THE RIEMANNIAN SPACE. Elyutin, P. V.; Krivchenkov, V. D. (Moscow State Univ.). Teor. Mat. Fiz.; 16: No. 3, 419-422(Sep 1973). (In Russian).

Expressions for the operators of momentum and kinetic energy in the Riemannian space are obtained from general quantum-mechanical requirements. The results make it possible to simplify the derivation of the Schrödinger equation in generalized coordinates from the classical Lagrangian function. The asymmetrical top is considered as an example. (auth)

## Quantum Field Theories

*Refer also to abstracts 1182 and 1452.*

**1964** (CNRS-CPT-73-P-528) EQUIVALENCE THEOREMS FOR EFFECTIVE LAGRANGIANS. Rouet, A. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Mar 1973. 17p. Dep. NTIS (U. S. Sales Only) $3.00.

Two combinatorial theorems related to W. Zimmermann's formulation of the Lagrangian perturbation theory are proved in view of applications to problems concerning symmetry breaking. (auth)

**1965** (DESY-73/30) LOCAL PARTICLE STRUCTURE OF STATES IN QUANTUM FIELD THEORY. Buchholz, D. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Jul 1973. 63p. (In German). Dep. NTIS (U. S. Sales Only) $5.25.

The local particle structure of states is investigated within the framework of local, relativistic quantum theory. For this purpose quantities are introduced which help to describe the extension of states and the size of the collision region. It can then be shown that the local particle structure of an important class of states is in complete agreement with intuitive expectations. In connection with these questions two problems are solved which seem to be of independent interest. An optimal estimate is given for the rate of convergence of the Haag-Ruelle approximations of scattering states. Furthermore, this convergence behavior can be shown to be intimately connected with the threshold behavior of the S-Matrix. These results are valid both in quantum field theory and nonrelativistic potential scattering theory. (orig.) (GE)

**1966** ALGORITHM FOR THE POLES AT DIMENSION FOUR IN THE DIMENSIONAL REGULARIZATION PROCEDURE. 'tHooft, G. (CERN, Geneva). Nucl. Phys.; B62: 444-460(1973).

One-loop Feynman diagrams, when regularized using the continuous dimension method, exhibit single poles at $n = 4$, and these poles can be eliminated by a counterterm $\Delta L$ in the Lagrangian. A simple algorithm is derived to express $\Delta L$ in terms of the components of the Lagrangian L without performing integrations. It can be used in dimensional regularization, but also to derive Callan-Symanzik type equations for small distance behavior in any renormalizable theory. The result of a calculation of the divergencies in quantum gravity is reported. (auth)

**1967** CONNECTION BETWEEN THE VERTEX FUNCTION IN COORDINATE SPACE AND IN MOMENTUM SPACE. I. Formalism. Andersson, B. (Princeton Univ., NJ). Nucl. Phys.; B62: 461-495(1973).

Formulas are derived which represent the coordinate space matrix elements of products of two field operators between the vacuum state and a state with sharp energy-momentum in terms of boundary values of the momentum space vertex function. The assumptions behind the results are (i) the general physical assumptions of a Wightman field theory and (ii) some moderate boundedness properties of the momentum space vertex function. The formulas will be used in an accompanying paper to investigate to what extent the coordinate space light cone singularities determine the momentum space structure. The resulting formulas closely resemble the corresponding two-point results. They contain mass integrals over the well-known distribution $\Delta_1^+$,-this time, however, modified by complex exponentials depending upon the external energy-momentum vector. (auth)

**1968** DIMENSIONAL REGULARIZATION AND THE RENORMALIZATION GROUP. 'tHooft, G. (CERN, Geneva). Nucl. Phys.; B61: 455-468(1973).

The behavior of a renormalized field theory under scale transformations $x \to \lambda x$; $p \to p/\lambda$ can be found in a simple way when the theory is regularized by the continuous dimension method. The techniques proposed here have several applications in dimensionally regularized theories: short distance behavior is expressed in terms of the single poles at $n = 4$, and all coefficients in front of the higher poles $1/(n-4)^k$ are expressed in terms of those of the single poles $1/(n-4)$, without calculating any diagram. In some cases the Taylor series in $1/(n-4)$ can be summed, leading to some exact results for the infinities of the full theory. (auth)

**1969** SOFTENED FIELD THEORY WITH VECTOR GLUONS. Nash, C. (Cambridge Univ., Eng.). Nucl. Phys.; B61: 351-369 (1973).

The light cone algebra of a field theory mediated by vector gluons, and softened at short distances, is investigated. An enlarged algebra containing the pseudo scalar, scalar and tensor bilocals is derived. The results are compatible with the canonical structure of light cone singularities which give rise to Bjorken scaling. The threshold behavior of $F_2(\omega)$ is investigated and an appropriate dynamical assumption found which gives the Drell-Yan-West threshold relation. The Regge properties of the current amplitude, and in particular its fixed pole structure, are examined and the usual fixed $q^2$ sum rules derived. (auth)

**1970** PADE APPROXIMATION OF TWO-POINT FUNCTIONS AND THE CALCULATION OF RESONANCES. Lambert, F. (Vrijé Univ., Brussels). Nucl. Phys.; B62: 301-324(1973).

The application of the method of Padé approximants to two-point functions of spin 0 and spin ½ is discussed in connection with the calculation of resonances in renormalizable Lagrangian field theory. The resonances which are considered belong to the Peierls class: they are excited states of a particle, with the same quantum numbers as the particle except parity, corresponding to complex poles of the propagator on an unphysical Riemann sheet of the energy plane. The diagonal Padé approximants are found to be particularly suited for approximating the mass function in the modified propagator, with regard to consistency with the Källen-Lehmann representation. Contrary to perturbative approximation, they open a way for avoiding ghost difficulties, yielding a finite wave renormalization constant. The analytic continuation of the propagator in the Padé approximation scheme is derived from that of the perturbation theory terms. A resonance equation is obtained on the real axis, the roots of which provide information on the masses of the possible resonances. The [1,1] Padé approximant is considered in the particular cases of the V-propagator in the Lee model and the nucleon propagator in the Yukawa model. (auth)

**1971** SCALE INVARIANT SCALAR YUKAWA COUPLING IN 4-EPSILON DIMENSIONS. Geicke, J.; Meyer, S. (Freie Univ., Berlin). Nucl. Phys.; B62: 325-332(1973).

Considering the preasymptotic zero mass theory of Yukawa-type and $A^4$ coupling it is found in lowest order of perturbation theory that in four space time dimensions the theory cannot be asymptotically scale invariant unless both coupling constants are vanishing. In $4-\epsilon$ dimensions ($\epsilon > 0$) one gets a scale invariant limit of the theory for large distances. The dynamical dimensions both of the Fermi and the Bose field are calculated. (auth)

**1972** ULTRAVIOLET ASYMPTOTICS IN QUANTUM FIELD THEORY AND SCALE INVARIANCE. Shirkov, D. V. (Joint Inst. for Nuclear Research, Dubna, USSR). Nucl. Phys.; B62: 194-202(1973).

High-energy asymptotic behavior in quantum field theory is studied on the basis of the differential Lie equations of the renormalization group. These equations are used in the Ovsiannikov-Callan-Symanzik form. The connection between scale-invariant asymptotics and the type of coupling constant renormalization is established. It is shown that power asymptotics correspond to finite as well as to some class of infinite coupling constant renormalization. A special case of power asymptotics in which it is impossible to assign anomalous dimensions to field operators is given. (auth)

**1973** NOTE ON THE PHASE OF HELICITY SPINOR. Shan, Y. (National Tsing Hua Univ., Hsinchu, Taiwan). Chin. J. Phys. (Taiwan); 11: No. 1, 88-91(Apr 1973).

It is pointed out that the phase of helicity spinor is related to the choice of a 2-spinor. The phase convention of Jacob and Wick is discussed. (auth)

**1974** ONE-TIME EQUATION FOR THREE-PARTICLE SYSTEM IN QUANTUM FIELD THEORY. Arkhipov, A. A.; Savrin, V. I. (Inst. of High Energy Physics, Moscow). Teor. Mat. Fiz.; 16: No. 3, 328-338(Sep 1973). (In Russian).

It is demonstrated how the one-time formulation of quantum field theory leads to the quasipotential equation for three-particle system. (auth)

**1975** HIGH ENERGY BEHAVIOR OF TREE DIAGRAMS IN GAUGE THEORIES. Bell, J. S. (CERN, Geneva). Nucl. Phys.; B60: No. 1, 427-436(1973).

Tree diagram scattering amplitudes may behave extra badly at high energy when vector mesons are involved. The cancellation, among bad terms, implied by gauge invariance is discussed. It is shown that in the renormalizable spontaneously broken gauge theories such cancellation is complete. (auth)

**1976** LOCALIZABILITY AND SINGLE-PARTICLE EXCHANGE AMPLITUDES. III. Renormalization. Rivers, R. J. (Imperial Coll. of Science and Tech., London). Nucl. Phys.; B60: No. 1, 367-378(1973).

Partial renormalization in the Van Hove-Durand model and a less naive generalization are re-examined. It is concluded that the non-locality of the effective theory is essential for even the simplest partial renormalization to be sensible. (auth)

**1977** $O_4$ INVARIANCE OF A BETHE-SALPETER EQUATION. Hite, G. E. (Univ. Trier-Kaiserslautern, Kaiserslautern, Ger.); Mueller-Kirsten, H. J. W.; Vahedi, N. Nuovo Cim.; 17A: No. 4, 652-662(21 Oct 1973).

The inhomogeneous equations of the three-point and four-point functions of the Wick-Cutkosky $\varphi^3$-theory are considered for masses $m_1$, $m_2$ of two of the three scalar particles, and four-momentum $q_\mu \neq 0$ of the bound state. The $O_4$ invariance of the homogeneous and inhomogeneous equations is explicitly verified. (auth)

**1978** APPROXIMATE METHOD OF SOLVING THE EDWARDS EQUATION WITH NONRENORMALIZABLE INTERACTION. Gogokhiya, V. Sh. (Joint Inst for Nuclear Research, Dubna, USSR). Teor. Mat. Fiz.; 16: No. 3, 339-348(Sep 1973). (In Russian).

In the framework of an exactly solvable model with nonrenormalizable interaction (the Edwards equation) the method of differential interpolation is proposed and studied, which makes it possible to construct the series of the modified perturbation theory in powers of $g^{\nu}(\ln g)^{n_\nu}$, $n_\nu$ being integer and $\nu$ - noninteger in general case. It is shown that the approximate solutions differ from exact ones in finite terms only. (auth)

## Gravitation and General Relativity

*Refer also to abstracts 1145–1147, 1401, and 1413.*

**1979** HYPERMASS GENERALIZATION OF EINSTEIN'S GRAVITATION THEORY. Edmonds, J. D. Jr. (Ames Research Center, Moffett Field, CA). Int. J. Theor. Phys.; 7: No. 6, 475-482(1973).

The curvilinear invariant quaternion formalism is examined for curved space time. Einstein's gravitation equation is shown to have a simple and natural form in this notation. The hypermass generalization of particle mass, which was generated in recent studies of the Dirac equation, is incorporated in gravitation by generalizing Einstein's equation. Covariance requires that the gravitational constant be generalized to an invariant quaternion when the mass is. The modification appears minor and of no importance cosmologically, unless time and mass dependence of G is considered. (auth)

**1980** PHYSICS OF A METRIC SPACE WITH A TIME VARIABLE. Kirkwood, R. L. Int. J. Theor. Phys.; 7: No. 6, 391-414(1973).

It is shown that the introduction of a time variable in a curved metric four-space of the Einstein type leads to an interpretation of gravity as an ether flow in a Riemannian three-space. It is assumed that the only motion that enters into physical laws is either motion relative to the ether or the relative motion of nearby points that are fixed in the ether, and this assumption is formulated analytically. A previous formulation of Newtonian fields in a metric four-space indicates that the three-space can be assumed to be Euclidean and provides field equations to determine the motion of the ether. It is also suggested that the velocity of light relative to the ether has the constant value c in many important physical fields. Finally, the observer's coordinates of the special theory of relativity are defined in the presence of a gravitational field. (auth)

**1981** PERIHELIC PROBLEM IN WHITEHEAD'S 3-SPACE. Tan, A. (Univ. of Florida, Gainesville). Chin. J. Phys. (Taiwan); 11: No. 1, 85-87(Apr 1973).

The effect of spatial geometry on planetary orbits in general relativity, long overlooked, has been discussed by Rindler. The same effect in Whitehead's theory of gravitation is discussed here. The results are compared with those of Rindler. (auth)

**1982** GRAVITATION. Misner, C. W.; Thorne, K. S.; Wheeler, J. A. San Francisco; W. H. Freeman and Company (1973). 1303p. $19.95.

The topics discussed cover space-time physics, physics in flat space-time, the mathematics of curved space-time, Einstein's geometric theory of gravity, relativistic stars, the universe, gravitational collapse and black holes, gravitational waves, experimental tests of general relativity, and the frontiers of physics. (JFP)

**1983** GHOST-FREE TENSOR LAGRANGIANS AND LINEARIZED GRAVITATION. van Nieuwenhuizen, P. (Laboratoire de Physique Theorique et Hautes Energies, Orsay, France). Nucl. Phys.; B60: No. 1, 478-492(1973).

The most general linear Lagrangian for massless and massive tensor fields without ghosts and tachyons is determined. Transversality is used to eliminate massless ghosts. The linear Einstein and Fierz-Pauli Lagrangians are unique for massless and massive tensor fields containing spin two. Hence, for gravitation, as for electromagnetism, gauge invariance and locality follow from positivity of the free-field energy. Symmetric and antisymmetric tensor theories with continuous zero-mass limit are found, but contain only spin one and spin zero. (auth)

# REACTOR TECHNOLOGY AND REGULATION

## Power Reactors, Non-Breeding, BWR-Type

***Refer also to abstracts 363, 364, 367, 382, 2057, 2059, 2066, 2072, 2083, 2087, 2105–2107, 2110, 2111, 2118–2136, 2138–2143, 2145, 2147, 2150–2152, 2155, 2156, 2161–2173, 2180–2209, 2214, 2216, 2224–2233, 2251–2265, 2277, 2291, 2295, 2297–2300, and 2302.***

**1984** (CONF-731105-2) REMOTELY OPERATED PLASMA TORCH: A TOOL FOR NUCLEAR REACTOR DISMANTLING. Beckers, R. M.; Blumberg, R.; Wodtke, C. H. (Oak Ridge National Lab., Tenn. (USA)). 1973. 28p. Dep. NTIS $3.50.

From winter meeting of American Society of Mechanical Engineers; Detroit, Michigan, USA (11 Nov 1973).

The Elk River Reactor facility is being dismantled in order to return the site to unrestricted use. The highly radioactive components — the reactor internals, the pressure vessel, and the outer thermal shield — have been cut up and shipped to a burial ground. Approximately 10,000 Ci of radioactive metal was removed without significant release of activity and without any overexposure to personnel. The dismantling was accomplished with a remotely operated plasma torch system. The design of the system, the results obtained, and evaluation of this technology are given. (6 references) (auth)

**1985** VARIATION OF THE VAPOR VOLUMETRIC FRACTION DURING FLOW AND POWER TRANSIENTS. Shiralkar, B. S.; Schnebly, L. E.; Lahey, R. T. Jr. (General Electric Co, San Jose, CA). Nucl. Eng. Des.; 25: No. 3, 350-368(1973).

An exact solution has been obtained for the variation of the vapor volumetric (void) fraction during exponential flow and power transients using the method of characteristics. The "void propagation" equation, as derived by Zuber and Staub was used and extended to the more general case of non-saturated inlet conditions. Transient void fraction measurements made with a capacitance-type void gage show good agreement with the theory, indicating that the simplifying assumptions made in the analysis are valid over a fairly wide range of void fractions. 9 references. (auth)

**1986** INTEGRITY ASSESSMENT OF STRUCTURAL MODELS OF A REACTOR VESSEL WITH NOTCHED NOZZLES UNDER CYCLIC PRESSURE LOADING. Fujimura, T.; Miyazono, S.; Kodaira, T.; Shibata, K. (Japan Atomic Energy Research Inst., Tokai). pp 801-819 of Second International Conference on Pressure Vessel Technology. II. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P2.

Tests undertaken to confirm the structural integrity of the Japan Power Demonstration Reactor (JPDR) pressure vessel are described. Prior testing considered two $\frac{1}{3}$ scale pressure vessel models subjected to static and cyclic internal pressure. Herein, experimental results are reported for a $\frac{1}{2}$ scale model of the JPDR pressure vessel with one prototypical nozzle and three additional nozzles. The strain distribution induced in the nozzles by 110 $kg/cm^2$ static internal pressure was determined using many strain gages. Then, after machining a notch on the nozzles, crack propagation under cyclic internal pressure was determined using many strain gages. Then, after machining a notch on the nozzles, crack propagation under cyclic internal pressure was measured by an electric resistance probe (Smeck) gage. These experimental results are reported and discussed. Comparisons of measured and predicted behavior are given. The number of cycles to failure for the JPDR pressure vessel is estimated to be greater than 60,000. (auth)

**1987** ANALYSIS OF THE FAILURE OF NUCLEAR REACTOR PRESSURE VESSEL CLOSURE STUDS. Burghard, H. C. Jr.; Pickett, A. G. (Southwest Research Inst., San Antonio). pp 581-595 of Second International Conference on Pressure Vessel Technology. I. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P1.

Two A-437 B4B closure studs of a nuclear reactor pressure vessel failed during the head removal operation. The service history of the vessel and the results of an in-depth investigation of the failure are reviewed. It was determined that the failures occurred by brittle fracture initiated at stress corrosion cracks. Subcritical crack growth was attributed to exposure to an aqueous environment while under load during outage. It was also demonstrated that the fracture toughness of the stud material was inadequate for the intended service. The stress corrosion susceptibility and low toughness of the material are attributed to unsatisfactory heat treatment procedures whose effect may not be detectable by the specified quality control tests. The basis for specifications for replacement stud material and recommended modifications of the in-service inspection program are presented. (auth)

**1988** STRESS ANALYSIS OF BWR PRESSURE VESSEL WITH BERSAFE AND FLHE. Elter, C. (Tuev Baden, Mannheim, Ger.); Waldner, K.; Reynen, J. pp 221-238 of Second International Conference on Pressure Vessel Technology. I. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P1.

A stress analysis of a BWR pressure vessel by means of the finite element programs BERSAFE and FLHE is presented. As concerns the overall analysis, two dimensional axisymmetric studies are made of upper and lower part of the vessel. Special attention has been given to the deformation and relative movement of upper flange of vessel and of the flange of the top lid respectively. The feed water nozzles and the pump nozzles for the penetration of the bottom spherical shell by the pump shafts were analyzed by using 3 dimensional isoparametric elements. Special mesh generation programs were used to deal with the discretization of the three dimensional structures. (auth)

## Power Reactors, Non-Breeding, PWR-Type

***Refer also to abstracts 360, 366, 368, 430, 436, 2018, 2057, 2059, 2061, 2062, 2069, 2071–2073, 2075–2080, 2083, 2084, 2087, 2109, 2112–2117, 2144, 2146, 2148, 2149, 2153, 2154, 2157–2160, 2174–2179, 2184, 2210–2213, 2215, 2221–2223, 2234–2250, 2266–2276, 2278–2290, 2292–2294, 2296, 2301, 2305, and 2306.***

**1989** (BAW-3647-25) PHYSICS VERIFICATION PROGRAM, PART III, TASK 6. Quarterly Technical Report, October–December 1972. McAdams, V. D.; Baldwin, M. N. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Research and Development Div.). Sep 1973. Contract AT(11-1)-3109. 37p. Dep. NTIS $4.00.

The detectability of gaps between fuel pellets in fuel rods is being determined by measuring thermal flux perturbations in the fuel assembly instrument guide tube. Also being determined are the power peaking in fuel rods surrounding a gapped fuel rod and the power and flux depression due to using an Inconel grid. The experimental assembly—a water-moderated, slightly enriched $UO_2$ lattice perturbed with a fuel rod containing a void—is arranged to mock up the fuel elements of a commercial pressurized water reactor. The neutron flux near the perturbation has been measured with a special rhodium incore detector having a 1-inch emitter and with gold foils. These results will serve as a check of analytical calculations on the effects of a fuel gap and its detectability. 6 references. (auth)

**1990** (BAW-10067) CONTAINMENT ISOLATION VALVES. Wrobel, G. J. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Sep 1973. 36p.

A generic isolation valve philosophy is provided showing B and W's conformation to AEC General Design Criteria 54, 55, 56, and 57. Valving arrangements are shown that are representative of isolation valve philosophy. (FS)

**1991** (CONF-731013-1) NUCLEAR DUAL-PURPOSE DESALINATION PLANT SIMULATOR. Delene, J. G. (Oak Ridge National Lab., Tenn. (USA)). 1973. 21p. Dep. NTIS $3.25.

From nuclear engineering symposium; Knoxville, Tennessee, USA (8 Oct 1973).

A simulator model for analyzing coupling and control problems in nuclear dual-purpose desalination plants using PWR type reactors is described. Some results showing typical responses of the plant to input perturbations are presented. (JWR)

**1992** (CONF-731021-1) ON-SITE NOISE DIAGNOSTICS AT PALISADES NUCLEAR POWER STATION. Fry, D. N.; Kryter,

R. C.; Robinson, J. C. (Oak Ridge National Lab., Tenn. (USA)). 1973. 14p. Dep. NTIS $3.00.

From an applications symposium on power plant dynamics, control and testing; Knoxville, Tennessee, USA (8 Oct 1973).

A real-time noise analyzer was used on-site at the Palisades nuclear plant to diagnose the cause of neutron flux oscillations. The analysis was compared with an earlier off-site analysis of tape recorded signals. The measurements and conclusions are described, and recommendations for application of on-site noise analysis in nuclear plants are presented. (HDR)

**1993** (ORNL-TM-4306) DIGITAL COMPUTER CODE FOR SIMULATING THE DYNAMICS OF FULL-SIZE DUAL-PURPOSE DESALTING PLANTS USING A PRESSURIZED WATER REACTOR AS A HEAT SOURCE. Delene, J. G. (Oak Ridge National Lab., Tenn. (USA)). Oct 1973. Contract W-7405-eng-26. 118p. Dep. NTIS $8.00.

A digital simulator was developed for use in calculating the dynamic response of full-size dual-purpose desalting plants. This simulator consists of a multistage flash (MSF) evaporator, a pressurized water reactor (PWR) as the heat source, a drum-type steam generator, and a turbine plant utilizing a back-pressure turbine. A bypass steam system was modeled to achieve flexible operation of the electric power and water portions of the combined plant. The proposed use of this simulator is to investigate various coupling and control schemes and to help determine possible problem areas in full back-pressure turbine dual-purpose desalting plant designs. (auth)

**1994** DETERMINATION OF THE DYNAMIC CHARACTERISTICS OF A PRESSURIZED WATER REACTOR PRIMARY LOOP. Olsen, B. E.; Singleton, N. R.; Bohm, G. J. (Westinghouse Electric Corp., Pittsburgh). pp 437-455 of Second International Conference on Pressure Vessel Technology. I. New York; American Society of Mechanical Engineers (1973).

From second international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P1.

Electrodynamic shaker forces were applied to one of the Indian Point, Unit 2, Primary Loops to determine the dynamic characteristics of the loop components; the steam generator, main coolant pump, and primary coolant piping. The majority of the testing was done during the reactor preoperational flow test period with primary coolant temperatures of from 70° to 450°F and shaker forces up to 800 lb. Accelerations were measured at approximately 20 locations during each test. Loop vibrations at operating conditions during flow tests were also measured for several pump/temperature combinations. The data were analyzed with analogue, hybrid, and digital computer techniques. The shaker method used (sinusoidal half-beat forcing functions) proved effective in providing adequate on-site information to define the various system modes and in producing accurate data for subsequent determination of mode shapes, natural frequencies, and damping. The system dynamic characteristics obtained from the shaker tests and the frequencies from the flow tests and a finite element analysis are presented. The experimental frequency values from both tests agree closely. Theoretical loop frequencies also show good correlation with experimental values. Besides the component natural frequencies, the loop frequency spectra at various operating conditions contain pump-speed-related frequency components at shaft and blade-passing speeds, plus their harmonics. Damping is shown to increase with frequency and displacement. (auth)

**1995** OFFSHORE NUCLEAR POWER PLANTS. Orr, R. S.; Dotson, C. (Offshore Power Systems, Jacksonville, FL). Nucl. Eng. Des.; 25: No. 3, 334-349(1973).

Offshore Power Systems, a joint enterprise of Westinghouse and Tenneco, has been formed to manufacture floating nuclear power plants. Commitments for the first two offshore plants have been received from the Public Service Electric and Gas Company. The floating nuclear plant concept is described with special reference to its advantages and its novel features. The novel features are a consequence of the floating aspect and include the design of the platform, the safety analysis and also the analysis and specification of plant motions due to environmental effects such as wind, waves and earthquakes. Site-related aspects such as the breakwater and mooring systems are discussed. The nuclear power plants will be manufactured in a central facility and this manufacturing concept is described. (auth)

**1996** FUTURE TRENDS IN ATOMIC POWER ENGINEERING. Morozov, I. (State Committee on Utilization of Atomic Energy, Moscow). J. Inst. Nucl. Eng.; 14: No. 4, 102-104(Jul 1973).

A review is given of the status of nuclear power in the USSR. It is stated that, within the next 10 to 15 years, the USSR will build nuclear stations mainly with pressurized water reactors of capacity up to 1000 MW and graphite-water reactors of the RBMK type with capacities of 1000 MW and upwards. International cooperation into ways of solving technical problems and improvement of the economic performance of reactors is stressed, including reliability, safety, and environmental problems. Work is also described on fast breeder power reactors and controlled thermonuclear fusion. As regards fast breeder reactors, it is stated that since 1969 the BOR-60 experimental reactor has been in use in the Dimitrovgrad region, and work is under way to put into operation a nuclear station wing. The BH-350 fast reactor at Shevchenko and a BH-600 reactor is being constructed at Beloyarsk. As regards fusion reactors international collaboration is again stressed. (UK)

**1997** DETERMINATION OF OPTIMUM FUEL LOADINGS IN PRESSURIZED WATER REACTORS USING DYNAMIC PROGRAMMING. Stout, R. B.; Robinson, A. H. (Oregon State Univ., Corvallis). Nucl. Technol.; 20: No. 2, 86-102(Nov 1973).

An iterative approach was adopted as the most practical method to search for an optimum fuel loading pattern in pressurized water reactors. A minimum peak-to-average power ratio was chosen as the objective characteristic of the optimum loading. A computer program SHUFLE employs a set of logical shuffling statements which utilizes the radial power shape and reactivity positioning of each iteration to predict a shuffle for the succeeding iteration. Independent logic is employed for different sections of the core and for fuel of relatively high and low reactivity. A two-dimensional simulated two-group coarse-mesh diffusion theory model is utilized to calculate the two-dimensional power distribution after each shuffle. The shuffling logic employed in SHUFLE was demonstrated adequate to predict acceptable loading patterns for initial, equilibrium, and nonequilibrium pressurized water reactor cores. (14 references) (auth)

## Power Reactors, Non-Breeding, Graphite Moderated

*Refer also to abstracts 915, 922, 1027, 1996, and 2217–2220.*

**1998** (GULF-GA-A-12167) PHYSICS STARTUP TEST PROGRAM FOR THE FORT ST. VRAIN HTGR. Brown, J. R.; Gillette, E. M.; Simon, W. A.; Van Howe, K. R. (Gulf General Atomic Co., San Diego, Calif. (USA)). 1 Aug 1972. Contract AT(04-3)-633. 28p. (CONF-720607-37). Dep. NTIS $3.50.

From tenth annual American Nuclear Society conference; Las Vegas, Nevada, USA (18 Jun 1972).

The zero power and approach-to-power test programs, with emphasis on safety and operational data, are discussed for the 330 MW(e) HTGR reactor. The test program will set a standard for testing future HTGRs provided with graphite moderators, helium cooling and coated carbide fuel particles. (FS)

**1999** PRESSURE DROP FOR PARALLEL FLOW THROUGH A ROUGHENED ROD CLUSTER. Maubach, K.; Rehme, K. (Kernforschungszentrum, Karlsruhe, Ger.). Nucl. Eng. Des.; 25: No. 3, 369-378(1973).

A method is described of calculating the pressure drop for parallel flow through rod clusters with artificial surface roughnesses in order to improve the heat removal. The method allows the extensive experimental data on artificial roughness to be applied to rod clusters. The method is based on universal flow parameters for roughness and on general laws describing the pressure drop in non-circular channels with rough walls. The method is tested on the basis of measured results obtained from a rod cluster with 19 rough rods. The parameters determined are in excellent agreement with data measured in rough tubes and annular gaps. In this way it is possible, given the geometrical shape of the roughness elements, to calculate pressure drops and flow distributions in artificially roughened rod clusters contained in a smooth channel. The simplistic approach using an average friction factor and an overall hydraulic diameter results in rather unrealistic flow distributions and hence temperature distributions across the cluster. 18 references. (auth)

**2000** FIRST 5 YEARS OF SERVICE OF THE CONCRETE PRESSURE VESSELS AT OLDBURY-ON-SEVERN NUCLEAR POWER STATION. Kelly, M. (Central Electricity Generating Board, Gloucester, Cheltenham, Eng.). pp 511-527 of Second International Conference on Pressure Vessel Technology. I. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P1.

The operational problems experienced and some of the maintenance and inspection difficulties of the first 5 years of service of the Central Electricity Generating Boards first concrete pressure vessels at Oldbury-on-Severn Nuclear power station are examined. The load check and examination carried out on the stressing cables are detailed. Some of the early problems with the insulation are listed and results of some samples removed subsequent to power operations are given. Gas leakage is discussed and concrete temperature measurements and strain gage information examined. The problems of access are highlighted and some details of vessel settlement are given. (auth)

2001 IMPROVEMENTS IN AND RELATING TO THERMAL POWER PLANT EMPLOYING GAS-COOLED NUCLEAR REACTORS. Jackson, A. B.; Pumphrey, J. S.; Wood, G. R. (to Parsons (C. A.) and Co. Ltd.). British Patent 1,323,881. 18 Jul 1973. Filed date 22 Jul 1969. 4p.

A power plant employing a gas cooled reactor is described, in which hot gas from the reactor is used in a closed cycle as the working fluid of a gas turbine plant. Gas exhausting from the turbine plant passes, prior to its return to the reactor, through a heat exchanger to cause vaporization of a separate working fluid used in a condensing vapor turbine plant. A portion of the hot gas is diverted from the gas turbine at a tapping point located between the reactor hot gas outlet and the exhaust end of the gas turbine and circulated in a further closed cycle through a separate portion of the heat exchanger where the separate working fluid is superheated. The heat exchanger has two evaporator sections connected in the closed circuit for the working fluid of the condensing vapor turbine, one section being heated by gas passing directly to the heat exchanger from the reactor and the other by gas passing to the heat exchanger from the gas turbine. The condensing vapor turbine may be a steam turbine. Arrangements are described for the inclusion of compressor means. Intercoolers may be provided. (UK)

2002 NORWAY SAYS NO TO INTERNATIONAL CORPORATION. Loses Competence and Money. Dybdahl, K. Tek. Ukebl.; 120: No. 35, 3(23 Aug 1973). (In Norwegian).

The decision by Norway to withdraw from the OECD DRAGON project is commented on. A brief evaluation of the advantages of the HTGR system is given and the ordering of several plants of this type in USA is mentioned. The advantageous economics of the DRAGON agreement for Norway and the contracts placed in Norway are stated and the hope expressed that the decision may be reversed. (NO)

2003 SUPPORTING DEVICE FOR A FUEL ELEMENT IN A NUCLEAR REACTOR CHANNEL. Bujas, R. (to Commissariat a l'Energie Atomique). French Patent 2,138,328. 24 May 1971. 6p. (In French).

A supporting device for the fuel elements in a channel of an HTGR nuclear reactor is described. In this type of reactor, the fuel elements may be in the form of hollow cylinders each consisting of a stock of annular nuclear fuel pellets distributed in a supporting matrix. In the device envisaged longitudinal fins are provided along the inner surface of the channel receiving the fuel element. These fins are regularly arranged about the axis of the channel and are provided with protuberances towards their inner parts. The radius at the lower end of these fins is greater than that presented along the rest of their length. The wide parts engage in the open vertical slits provided at the lower end of the fuel element. (FR)

## Power Reactors, Non-Breeding, Otherwise Moderated

*Refer also to abstracts 2058, 2074, and 2102.*

2004 OUTLINE OF DEVELOPMENT ON PRESSURE VESSEL STRUCTURE FOR THE PROTOTYPE ADVANCED THERMAL REACTOR FUGEN. Shibato, E. (Hitachi, Ltd., Ibaraki, Japan); Akebi, M. pp 1-23 of Second International Conference on Pressure Vessel Technology. I. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P1.

The Prototype Advanced Thermal Reactor (ATR, heavy water moderated, light water cooled), named FUGEN, is now under development as a national project in Japan. The pressure vessel structure of the Prototype ATR "FUGEN", which consists of pressure tube assemblies, a calandria and thermal shields, is quite different from those of conventional BWR or PWRs. Therefore, prior to the design, fabrication, inspection and testing, and in-service inspection, many kinds of research and development programs were planned and performed. Based upon the results so obtained, the safety of the structure was fully confirmed and the engineering basis of the design, fabrication, inspection and testing, and in-service inspection was also completely established. (auth)

2005 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Anderson, R. N.; Parlee, N. A. British Patent 1,323,475. 18 Jul 1973. Filed date 13 Nov 1970. 12p.

The reactor described employs a fuel system comprising a critical mass of U nitride fuel in contact with a non-critical solution of fissile metal in a molten metal solvent of low neutron absorption cross section. The fuel system is contained in an inert refractory reactor vessel under a $N_2$ atmosphere. The molten metal solvent consists of Sn, and graphite is employed for the reactor vessel. The non-critical solution is present in an amount sufficient to dissolve metal fission products, while precipitating from solution an amount of nitride substantially equal to that lost by fission. The $N_2$ atmosphere is maintained under pressure and temperature conditions conducive to maintaining the fuel system at the desired temperature as fission occurs and heat is withdrawn from the reactor. A portion of the molten metal solution is withdrawn from the reactor vessel as fission continues, freed from metal fission products, and then returned to the reactor vessel. Removal of the metal fission products is accomplished by subjecting the molten metal solvent to nitrification under conditions of temperature and $N_2$ pressure to selectively precipitate in nitride form the fuel present. The precipitated nitride fuel is returned to the reactor, the metal fission products removed from the residual molten metal solution, and the remaining molten metal solution returned to the reactor vessel. Removal of the metal fission products from the residual molten metal solution may be effected by fractional distillation or by further nitrification under appropriate temperature and $N_2$ pressure conditions. (UK)

2006 $UO_2$ PELLET STACK SHORTENING IN A BOILING WATER REACTOR. List, F.; Knudsen, P. (Danish Atomic Energy Commission, Risoe). Nucl. Technol.; 20: No. 2, 103-108(Nov 1973).

Fuel pins of $UO_2$-Zr were irradiated to a burnup of 5600 MWd/MT $UO_2$ in the OECD Halden Boiling Water Reactor. As a result, the pellet stacks shortened by ~0.7%. A mathematical model, based on a ratcheting pellet movement resulting from mechanical fuel-cladding interaction during successive irradiation periods, accounted well for the observed decrease in length. Examination of the inside of the cladding at several axial locations confirmed the ratcheting mechanism and indicated no contribution to pellet-stack shortening from isotropic fuel densification. (9 references) (auth)

## Power Reactors, Breeding

*Refer also to abstracts 275–277, 279, 283–285, 287–289, 291, 292, 304–306, 311, 313, 316, 330, 365, 914, 920, 948, 949, 1996, 2085, 2101, and 2108.*

2007 (CONF-731105-3) ELASTIC-PLASTIC-CREEP ANALYSIS OF THERMAL RATCHETTING IN STRAIGHT PIPE AND COMPARISONS WITH TEST RESULTS. Corum, J. M.; Sartory, W. K. (Oak Ridge National Lab., Tenn. (USA)). 1973. 31p. Dep. NTIS $3.75.

From winter meeting of American Society of Mechanical Engineers; Detroit, Michigan, USA (11 Nov 1973).

An experimental and analytical study of ratchetting in a simple structural component is described. A straight pipe from a well-characterized heat of Type 304 stainless steel was subjected to a series of thermal downshocks followed by sustained periods of high-temperature operation under internal pressure. The test was performed in a special sodium test facility built for the purpose. The inelastic analysis predictions were obtained using a one-dimensional finite-element procedure, and they were based on interim constitutive equations that have been recommended for use in design analyses of liquid-metal fast-breeder reactor components. The agreement between the measured and predicted ratchetting behavior is good. (8 references) (auth)

2008 (GEAP-12444) THERMODYNAMIC DATA PROGRAM INVOLVING PLUTONIA AND URANIA AT HIGH TEMPERATURES. Quarterly Report No. 24, May 1, 1973—July 31, 1973. Aitken, E. A.; Adamson, M. G.; Dutina, D.; Evans, S. K.; Ludlow, T. E. (General Electric Co., Pleasanton, Calif. Vallecitos Nuclear Center). Aug 1973. Contract AT(04-3)-893. 28p. Dep. NTIS $4.00.

Progress is reported on the continuing scope of work related to fission-product cladding interaction, sodium-fuel chemical interaction, and O:M and Pu:U redistribution. (auth)

**2009** (GEAP-13538) PERFORMANCE OF MIXED-OXIDE FUEL RODS IRRADIATED TO 13 ATOM PERCENT BURNUP IN EBR-II. Hilbert, R. F.; Perry, K. J.; Appleby, W. K.; Baily, W. E.; Craig, C. N. (General Electric Co., Sunnyvale, Calif. Breeder Reactor Dept). Apr 1973. Contract AT(04-3)-893. 172p. Dep. NTIS $7.60.

Successful operation of stainless steel clad mixed-oxide fuel rods to 13 at. % burnup was demonstrated in an irradiation test in EBR-II. Two rods clad in solution-annealed Type-316 stainless steel and one rod clad in solution-annealed Type-347 stainless steel operated at average linear power ratings above 12 kW/ft and peak cladding temperatures of 580°C (1075°F) to ~13 at. % burnup. Three additional stainless steel clad rods and one rod clad in Incoloy-800 were irradiated under similar conditions to burnups near 7 at. %. Peak cladding diameter increases ranged from 1 to 5.5%. Cladding density measurements indicated that a major portion of the measured cladding diameter increase was the result of metal swelling. Peak fast fluence exposure was $0.89 \times 10^{23}$ n/cm$^2$. One high-burnup rod, with a smeared density of 93% and an axially restrained fuel column, exhibited a maximum cladding inelastic strain of 1.5%. Analysis of dimensional change data indicated that fuel-cladding mechanical interaction occurred between ~3 and 8 at. % burnup. At higher burnups, the cladding swelling rate increases markedly, resulting in negligible additional fuel-induced cladding deformation. Cladding inelastic strain was found to be independent of smeared density in the range from 83 to 91% TD. (auth)

**2010** (GEAP-13971) PERFORMANCE OF LMFBR FUEL RODS AT HIGH CLADDING TEMPERATURES (GROUP F5). Hilbert, R. F.; Black, T. J.; Challenger, K. D.; Appleby, W. K. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). Jun 1973. Contract AT(043)-893. 55p. AT.

Three encapsulated mixed-oxide fuel rods clad in cold worked Type-316, solution annealed Type-316, and solution annealed Type-321 stainless steels were irradiated at peak cladding temperatures up to 1170°F and to peak burnups of approximately 6 at. %. All three claddings were in good condition after reactor exposure with a maximum inside surface chemical attack of approximately 0.001 inch. The pulsed eddy current (PEC) system was shown to be an effective tool for detecting regions of cladding that have been chemically attacked. All three fuel rods underwent cladding inelastic strain. Maximum inelastic strain of 0.54% occurred in the 50% cold-worked Type-316 stainless steel cladding, which exhibited no metal swelling. Analysis of mechanical interaction in the fuel rods suggests that fuel swelling was a primary cause of cladding inelastic strain. 5 references. (auth)

**2011** (HEDL-TME-73-66) INTERIM REPORT: IN-REACTOR PERFORMANCE OF INSTRUMENTED EBR-II SUBASSEMBLY XX04 (HEDL-P-17A). Horn, G. R.; Millhollen, M. K. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Aug 1973. Contract AT(45-1)-2170. 57p. AT.

The second HEDL Instrumented Subassembly Test in EBR-II (XX04) contained four mixed oxide fuel pins with W-Re thermocouples located in the fuel columns. Cold fuel-to-cladding gaps were 0.008 in. in two pins and 0.006 inches in the other two pins. Results recorded during irradiation in EBR-II are compared to results predicted by use of GAPCON. It was concluded that hot fuel-cladding gap widths decrease significantly during the first days of steady-state irradiation. (auth)

**2012** (ORNL-TM-4364) FAST REACTOR EXPERIMENTAL SHIELDING MONTHLY PROGRESS REPORT FOR JULY 1973. 189a No. 10028, Activity No. HN 04 01 01 1. Clifford, C. E.; Muckenthaler, F. J.; Stevens, P. N.; Freestone, R. M. Jr. (Oak Ridge National Lab., Tenn.). Sep 1973. Contract W-7405-eng-26. 40p. AT.

The FTR Inconel experiment was completed during July, 1973 and includes shield configurations with Inconel thicknesses of $2^1/_2$ and 5 in. The experiment was designed to study neutron transport through Inconel and the associated production of secondary gamma rays. Spectral measurements were made with the NE-213 spectrometer and the hydrogen counter and integral flux measurements with Bonner balls. The gamma-ray spectra were taken with a 5-in. sodium iodide spectrometer. A repeat NE-213 spectral measurement was also performed for the 22-in. iron configuration to resolve a disagreement between the NE-213 and hydrogen counter spectra in the overlap region. (auth)

**2013** LOW-CYCLE FATIGUE STRENGTH OF PIPING COMPONENTS. Ando, Y. (Tokyo Univ.); Yagawa, G.; Kawaguchi, O.; Okabayashi, K.; Ueda, S.; Nagata, T. pp 723-742 of Second International Conference on Pressure Vessel Technology. II. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P2.

To assess the low-cycle fatigue strength of the piping components such as elbows and branch connections, the following experiments were performed: strain controlled push-pull low-cycle fatigue tests on smooth hour-glass type specimens and grooved cylinder specimens of Type 304 stainless steel, and load-controlled or displacement-controlled low-cycle fatigue tests on elbows and branch connections of 12 in. dia and $^1/_4$ to $^3/_8$ in. wall thickness Type 304 ss with cyclic in-plane bending moment loading. Based on the results of the works, the current ASME Code procedures for low-cycle fatigue design for primary-plus-secondary stress intensity range above $3S_m$ are assessed. (auth)

**2014** RATCHETTING DEFORMATION AS AFFECTED BY RELATIVE VARIATIONS OF THE LOADING SEQUENCE. Anderson, W. F. (Liquid Metal Engineering Center, Canoga Park, CA). Contract AT(04-3)-700. pp 277-288 of Second International Conference on Pressure Vessel Technology. I. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P1.

As part of a program undertaken to obtain experimental verification of the magnitude and effect of creep ratchetting in high-temperature, sodium-cooled reactor design, tests were performed to extend the range of the ratchetting test parameters from that of a previous study and to examine the effect of relative variations in the loading sequence. Test results over the extended range of parameters tend to verify the analytical predictions of the magnitude of plastic ratchetting strain per cycle made by Bree and by Burgreen. The sensitivity of the amount of ratchetting strain per cycle to the phase relation between the bend cycle (thermal transient) and the axial stress (internal pressure) indicates that care should be taken in preparing design specifications to properly show the variations in system pressure relative to the thermal transients and hold times. (auth)

**2015** CONTROL AND MONITORING OF FAST NEUTRON POWER REACTORS. Lions, N. (CEN de Cadarache, Saint-Paul-les-Durance, France); Baron, J.; Berger, R.; Bret, A.; Buis, H.; Fournier, C.; Pages, J. P.; Cauvin, J. C.; Rulleau, A.; de Lapparent, D.; Poinsot, J.; Cambillard, A. Bull. Inform. Sci. Tech. (Paris); No. 182, 71-83(Jun 1973). (In French).

The use of liquid sodium as a coolant gave rise to a number of measurement and control problems, most of which are new. A specific instrumentation is required to take into account the special properties of this fluid. New problems arose such as: water leakage detection in sodium, visualization in an opaque fluid, cladding failure detection and especially location in the sodium coolant, and moreover the difficulties connected with a highly compact core. Other research work extending beyond the sodium cooled reactors was undertaken in the field of ultrasonic techniques and acoustical detection. Ultimately a more general preoccupation led to studying a core defect detection and diagnostic system using overall processing of data measured in the reactor, to detect failures at the moment they occur. (FR)

**2016** REACTOR BLOCK AND FUEL HANDLING. Abramson, R. (CEN de Cadarache, Saint-Paul-les-Durance, France); Aubert, M.; Berniolles, J. M.; Merland, D.; Sauvage, M.; Verrieres, P.; Leduc, J. Bull. Inform. Sci. Tech. (Paris); No. 182, 29-38(Jun 1973). (In French).

Preliminary studies of the reactor block and fuel handling were made and various reactor designs were compared. Consequently a choice was made taking into account the technological attainments of Rapsodie and Phenix. (FR)

**2017** HANDLING CONTAINER FOR A FUEL ASSEMBLY. Geffroy, J.; Merland, D. (to Commissariat a l'Energie Atomique). French Patent 2,147,777. 28 May 1971. 6p. (In French).

A handling container is presented for a nuclear reactor fuel assembly cooled by liquid metal and provided with means for circulating this liquid (sodium). The device has a stainless steel cylindrical envelope which eliminates the heat by radiation and an internal sleeving consisting of a heat insulator (wool mineral) contained between two metallic walls. The inner wall mates (with the necessary play) with the profile of the fuel assembly cross section, holed parts ensuring a mechanical joint between the envelope and the inner sleeving. (FR)

**2018** USE OF METALLIC THORIUM FOR LWBRs AND LWRs. Zorzoli, G. B. (Centro Informazioni Studi Esperienze, Milan). Nucl. Technol.; 20: No. 2, 109-113(Nov 1973).

The potential of metallic thorium as a reactor fuel has been examined. Two particular cases were taken into consideration: a light water breeder reactor (LWR) and a pressurized water reactor (PWR). The comparison with a standard LWBR (ThO$_2$)

and with a standard PWR ($UO_2$) points out the potential benefits of the proposed concepts from the economic point of view, as well as from that of conserving natural resources. (13 references) (auth)

**2019** FIRST REPORT ON APPARATUS TO SIMULATE IN-REACTOR TRANSIENT HEATING CONDITIONS IN OXIDE FUEL COLUMNS. Wrona, B. J.; Roberts, J. T. A.; Johanson, E.; Tuohig, W. D. (Argonne National Lab., IL). Nucl. Technol.; 20: No. 2, 114-123(Nov 1973).

An apparatus has been developed that simulates, out-of-reactor, both in-reactor thermal gradients and heating rates in oxide fuel pellet stacks through direct electrical heating. Preliminary results of tests of both steady-state and transient operation indicate that fuel phenomena and fuel microstructures similar to those observed in actual in-reactor transients can be produced. (6 references) (auth)

## Research, Test, and Experimental Reactors

*Refer also to abstracts 320, 1055, 2050, 2092, 2104, and 2137.*

**2020** (AEC-tr-7477) CALORIMETRIC MEASUREMENT OF RESIDUAL POWER OF RAPSODIE AND FORTISSIMO FUEL ELEMENTS. Devillers, C.; Lhiaubet, G.; Lott, M.; N'guyen Van Dat; Dufreche, F. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). 1973. Translated from French Report. 46p. Dep. NTIS $4.50.

Calorimetric measurements on irradiated fuel pins from the Rapsodie and Fortissimo cores were made to determine the residual power in the fuel. The results indicate the possibility of applying calorimetric measurements of residual power to the determination of the average burnup rate in fast reactor fuels. (JWR)

**2021** (CONF-700867-) EUROPEAN TRIGA OWNERS' CONFERENCE, OTANIEMI, FINLAND, AUGUST 25–27, 1970. (Helsinki Univ. of Technology, Otaniemi (Finland)). 1970. 349p.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

Twenty-six papers were presented by speakers representing all of the TRIGAs operating in Europe, two in the U. S., and one in Japan. The abstract for one of the papers appeared in NSA 28: 12080. Abstracts for the other papers have been prepared. (FS)

*For abstracts of individual papers see: 453, 2022–2045, and 2104.*

**2022** (CONF-700867-, pp 1-4) EXPERIENCE IN THE OPERATION AND MAINTENANCE OF THE AUSTRIAN TRIGA MARK II REACTOR. Boeck, H. (Oesterreichische Hochschule, Vienna). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

The Austrian TRIGA Mark-II Reactor was operated from March 1962 until July 1964 at 100 kW. In 1964 a power increase to 250 kW was made. Since 1968, there have been no problems. The instrumentation, core components, photoneutron source, absorber rods, irradiation facilities and the tank and water sytem are briefly described. (FS)

**2023** (CONF-700867-, pp 5-19) FIVE YEARS OF OPERATING THE TRIGA MAINZ REACTOR. Benedict, G. (Johannes Gutenberg-Univ., Mainz). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

Considerable obstacles had to be surmounted before TRIGA MAINZ, first TRIGA reactor built in Germany, reached initial criticality in 1965. Subsequent five years' operation did not raise any major problems. The facility has proven quite reliable and particularly well suited for the purposes of the nuclear chemistry research program pursued at Mainz University. Extensive use is made of the pulse mode of operation. As a result, fuel elements are obviously somewhat overstressed, even though most pulses performed are of the 1.50 dollar size. Maximum licensed steady state power of 100 kW till now has met the requirements of most experiments. However, efforts are in progress to improve irradiation conditions by increasing the reactor power to 300 kW. (auth)

**2024** (CONF-700867-, pp 20-42) EXPERIENCE IN THE OPERATION AND MAINTENANCE OF THE L.E.N.A. 250 kW TRIGA MARK II REACTOR AT THE UNIVERSITY OF PAVIA, 1966-1970. Cambieri, A. (Univ., Pavia, Italy); Cingoli, F.; Genova, N.; Meloni, S.; Orvini, E. 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

Experience in the operation and maintenance of the L.E.N.A. 250 kW TRIGA Mark II reactor at the University of Pavia is described. Some historical notes, administration, and personnel of LENA are presented. Reactor operation since 1966 is reported together with the cost of a recent one year period. Some minor operational difficulties such as a crack in the biological shield and fuel element elongations are described in detail. The activity of the health physics group is also presented. (auth)

**2025** (CONF-700867-, pp 43) RIKKYO REACTOR OPERATING EXPERIENCE. Hattori, M. (Rikkyo Univ., Yokosuka, Japan). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

Rikkyo University TRIGA reactor became critical in December 1961. The facility usage is about 700 MWhs. The reactor (100 kW) was constructed in the early days and only minor reconstruction was done. The TRIGA reactor of Musashi Institute for Technology, which became critical in January 1963, is in a similar situation. In the beginning, a Po-Be neutron source was used, but recently there is no special neutron source. The reactor can be started by photoneutrons produced from the photodisintegration of $D_2O$ contained in the core water, by high energy gamma rays from $^{140}$Ba-$^{140}$La (half-life 13 days), if the control rods' position indication is at a critical state and is approximately known. Power calibration is made every year, and the drift of the percent power meter indication is within 2% in the 9 years' operation. Demineralizer resin was exchanged twice a year. Recently, very slight fission product activities are contained in the used resin with the quantity increasing slightly. Similar result was also found in the Musashi reactor. Whenever a rotation difficulty of the lazy susan occurred, a cup of oil was poured through the drive shaft casing, but in 1968 it became very difficult to rotate. The inside of the lazy susan was cleaned with methylethyl ketone according to the suggestion of GGA. Good results were obtained. In the Musashi reactor the drive shaft was broken and not used. Recently the recorders on the control console were out of order. Another two-pen recorder with a shorter damping time constant is under test. In the Musashi reactor, the inside of the heat exchanger pipes was cleaned with dilute oxalic acid, and the cooling power was improved. (auth)

**2026** (CONF-700867-, pp 44-54) EXPERIENCE DURING 4 YEARS OF OPERATION OF THE TRIGA MARK I HEIDELBERG IN THE INSTITUTE OF NUCLEAR MEDICINE OF THE GERMAN CANCER RESEARCH CENTER. Maier-Borst, W.; Krauss, O.; Lorenz, W. J.; Ostertag, H.; Scheer, K. E. (German Cancer Research Center, Heidelberg). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

After $10^6$ kWh of operation, practical experiences with the 250 kW research reactor are reported. The special requirements of a biomedical institute concerning the irradiation positions and the peripheral equipment of the reactor are described. Based on 4 years of practical experience, a modified conception of a 1 MW TRIGA Reactor is presented. This concept is actually under construction in a new building of the German Cancer Research Center. (auth)

**2027** (CONF-700867-, pp 55-70) EXPERIENCE IN THE OPERATION AND MAINTENANCE OF THE FIR 1 REACTOR. Anttila, K. (Helsinki Univ. of Tech., Otaniemi, Finland). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

The Finnish TRIGA MkII reactor FiR1 has been in operation from 1962. Its maximum steady-state power level was raised from 100 kW to 250 kW in the summer of 1967. The effect of electrical defects, such as instrument failures and instrument shut-downs, on the use of the reactor has been usually negligible. The reliability of the electrical and mechanical systems from this point of view can be examined generally with the aid of shut-down statistics. The rotary specimen rack is the most important reliability problem of the FiR1 reactor. The neutron flux values and distribution in the reactor core and its vicinity were determined by activation and absolute ($4\pi\beta-\gamma$) counting of gold foils and with copper foils and wires which were compared with the gold foil measurements. The reactivity values of core elements, specimens, research devices, etc. and the influence of a black absorber in the specimen ring on the reactor power were measured. (auth)

**2028** (CONF-700867-, pp 89-105) UPGRADING THE IPR-E1 TRIGA REACTOR TO 250 kW. Andrade, V. M. (Instituto de Pesquisas Radioativas, Belo Horizonte, Brazil). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

A description of the problems connected with the future upgrading of the IPR-R1 reactor is presented. Initially two steady state power levels were considered, namely 250 kW and 1,000 kW. The adoption of a steady state power of 250 kW was the result of a compromise between maximum utilization of the original reactor components and the attainment of a fairly high power level at reasonable cost. The power upgrading program includes the possibility of pulsing the reactor to 1,000 MW. Core loading configurations are considered. A preliminary evaluation of the excess reactivity to be achieved is determined. (auth)

**2029** (CONF-700867-, pp 106-121) ADDITIONAL IRRADIATION FACILITIES AT THE TRIGA MARK III REACTOR FRN. Grundler, W.; Kern, W. (Gesellschaft fuer Strahlenforschung mbH, Munich). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

To increase the irradiation capacity of the reactor, an additional pneumatic transfer system is planned. It consists of four rabbit tubes, to be installed in the original beam port R 3 to allow the irradiation of four capsules ("rabbits") simultaneously. Two of these tubes are to be provided for standard irradiations. This so-called "slow rabbit system" is operated in a closed circuit with $CO_2$ as propellant gas in order to avoid release of AR-41. A forced convection cooling circuit enables the long-time irradiation of samples up to 50 g of weight without exceeding temperatures above 80°C. The other two tubes are considered for a fast rabbit system, which is to be operated with compressed nitrogen (8 atm) as the propellant. Since the loading station is situated near the reactor shield, a time of flight below 200 ms is to be obtained, so that investigations of very short-lived isotopes will be possible. (auth)

**2030** (CONF-700867-, pp 122-134) IMPROVEMENTS AT THE TRIGA MARK III REACTOR FRN. Rau, G.; Kern, W. (Gesellschaft fuer Strahlenforschung mbH, Munich). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

During the design and construction of the FRN, several technical improvements could be accomplished, which will facilitate the reactor operation. First, a tube system for forced convection cooling was provided. For this, aluminum tubes of 300 mm diameter were built in the reactor shield, so that a conversion from free to forced convection can be managed later on. Except for a possible power-upgrading, several other advantages are given by forced convection cooling, e.g., faster and more exact determination of thermal power, lower specific fuel temperatures connected with less reactivity losses, and very precise power-regulation by means of the N-16 method. Another very important improvement is the reconstruction of the reactor bridge, the center of which will be raised up to 180 cm in height to give better access to the core and facilitate fuel element handling. The beam-ports R1–R4 and T1–T4 are vacuum-tight in contrast to the original types. Except for the experimental advantages gained by this procedure, the Ar-41 production is highly reduced. For irradiation of large samples, two additional grid plates are provided, which will be mounted beside the core at the beam-ports R3 and R4. A minor improvement, a Sb–Be neutron source should be mentioned, to be inserted into the reactor after beginning operation. It replaces the Po–Be source when sufficiently activated. (auth)

**2031** (CONF-700867-, pp 135-161) IN-CORE FUEL MANAGEMENT AND ATTAINABLE FUEL BURNUP IN TRIGA. Saastamoinen, J.; Siltanen, P.; Kaloinen, E. (Helsinki Univ. of Tech., Otaniemi, Finland). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

The principles of in-core fuel management in research reactors, and especially in TRIGA, are discussed. Calculations made to determine the attainable fuel burn-up values of various fuel element types in the Otaniemi TRIGA Mark II reactor are described and the results obtained are given. Recommendations are given of how to perform the in-core fuel management to achieve good fuel utilization. The results obtained indicate that burn-up values of up to 5 and 2.5 MWd/element can be achieved for the 8 wt-% U aluminum clad and the 8.5 wt-% U stainless steel clad elements, respectively. (auth)

**2032** (CONF-700867-, pp 162-170) $^{41}$Ar-CONCENTRATION MEASUREMENTS AT THE FINNISH TRIGA MARK II. Tamminen, A. (Helsinki Univ. of Tech., Otaniemi, Finland). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

$^{41}$Ar-concentrations in the reactor hall and in the Ar-ventilation duct of FiR-1 (TRIGA Mark II, 250 kW) have been measured during normal operation conditions. Additional measurements have been performed varying Ar ventilation and hall ventilation flow. A $\gamma$- and background compensated thin window proportional detector and a $\beta$-Geiger detector for $^{41}$Ar-measurements are described. The hall concentration has also been estimated from background measurements with an unshielded Ge(Li)-detector. The saturation concentration in the reactor hall with and without the hall ventilation is $1 \times 10^{-7}$ $\mu$Ci/cm$^3$ and $3 \times 10^{-7}$ $\mu$Ci/cm$^3$, respectively. (auth)

**2033** (CONF-700867-, pp 180-201) USE OF THE RESEARCH REACTOR TRIGA-HEIDELBERG IN NUCLEAR MEDICINE AND BIOLOGY. Krauss, O.; Lorenz, W. J.; Maier–Borst, W.; Ostertag, H.; Scheer, K. E.; Wolber, G. (German Cancer Research Center, Heidelberg). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

The TRIGA Mark I Heidelberg in the Institute of Nuclear Medicine of the German Cancer Research Center is exclusively used for medical and biological research. One of the principal aims of nuclear medicine is the early diagnosis of tumours. For the detection of bone tumours the short-lived radionuclide $^{18}$F has proved best. The uptake rates of the bone seeking radionuclides $^{18}$F, $^{72}$Ga, $^{87}$Sr$^{m}$, $^{153}$Sm in bone tissue were investigated. For liver and other soft tissue tumours the radionuclides $^{64}$Cu, $^{59}$Fe, $^{198}$Au were used. Investigations of fat resorption with $^{82}$Br are described. The research program on the concentrations of the essential trace elements Mn, Cu, and Zn in tumour bearing rats is presented. A chemical separation scheme for 40 elements which are produced by irradiation with thermal neutrons and with half-lives longer than 30 min is reported. (auth)

**2034** (CONF-700867-, pp 202-209) APPLIED RESEARCH WITH RC-1 TRIGA REACTOR OF THE CASACCIA CENTER, C.N.E.N. Lo Prato, E. (CNEN, Casaccia, Italy). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

A brief description of the reactor experimental facilities is followed by a comprehensive review of research work performed in the F.N.A. Laboratory of Casaccia Center, which the reactor is built in. Main research in progress concerns topics of both nuclear and solid state physics, namely radiative properties of nuclear levels, high resolution $\gamma$-ray spectroscopy, structure and dynamic properties of magnetic materials. The F.N.A. Laboratory is also developing applied research topics: planned programs include activation analysis, development of neutron radiography techniques, studies on defective solids, in detail on radiation damaged ones. (auth)

**2035** (CONF-700867-, pp 210) RESEARCH PROGRAMS USING RIKKYO TRIGA REACTOR. Hattori, H. (Rikkyo Univ., Yokosuka, Japan). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

At Rikkyo University, the TRIGA reactor is used as the neutron source for fundamental research of reactor physics and engineering, nuclear and solid state physics, and nuclear and hot atom chemistry. The main use of the reactor is in neutron irradiation of samples using the lazy susan. (FS)

**2036** (CONF-700867-, pp 211-212) CURRENT RESEARCH PROJECTS AT THE AUSTRIAN TRIGA MARK II. High Sensitive Detection of Rare Fission Gas Release of a Fuel Element Sample of the TRIGA Mark II Reactor in Vienna. Boeck, H.; Brunner, P.; Fleck, C. M. (Oesterreichische Hochschule, Vienna). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

The temperature dependent release of rare fission gas products is measured to provide information for the determination of cladding material thickness and burnup. A $\beta$-$\gamma$ low-level coincidence spectroscope is used. In-pile equipment includes two thermocoax resisting heating wire coils of 25 kW power. (FS)

**2037** (CONF-700867-, pp 213-217) LOCATION OF FAILED FUEL ELEMENTS IN AUSTRIAN TRIGA MARK II. Boeck, H.; Fleck, C. M. (Oesterreichische Hochschule, Vienna). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

A system and method are described for detecting radioactive krypton and xenon in the primary coolant circuit and to allow selective control of any fuel element for its fission gas release. Suspected gases are observed in a counter consisting of three coaxial counters. (FS)

**2038** (CONF-700867-, pp 222-233) LARGER RESEARCH PROGRAMS AT THE BEAM HOLES OF THE AUSTRIAN TRIGA MARK II REACTOR. 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

A polarized neutron spectrometer and a neutron spin-flip chopper used at the tangential beam tube are described. An automatic pneumatic tube system with a 15 msec transfer time is used in a beam hole in a search for isometric transitions in the range from $10^{-4}$ to 1 sec. A Fourier chopper-selector was designed and is being constructed. This equipment will chop the beam in the way necessary for Fourier analysis and will also select the energy. (FS)

**2039** (CONF-700867-, pp 234-245) RESEARCH PROGRAMS AT THE L.E.N.A. TRIGA NUCLEAR PLANT OF THE UNIVERSITY OF PAVIA, 1968–1970. Maxia, V.; Meloni, S.; Orvini, E.; Pinelli, T. (Univ., Pavia, Italy). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

The research programs at the L.E.N.A. TRIGA Nuclear Plant are described. These programs are carried out mainly by three groups of researchers: the low energy group of the Institute of Nuclear Physics, solid state group of General Physics, and Radiochemistry Laboratory of the Institute of General and Inorganic Chemistry. The low energy group has addressed its interest on ternary fission and neutronics. The solid state group mainly studies photoconductivity phenomena on fast neutron irradiated semiconductors. The Radiochemistry Laboratory mainly operates on nuclear parameters measurements, nuclear fission studies and nuclear activation analysis. The present status of the research and the planned programs are summarized for each of the groups involved in the program. (auth)

**2040** (CONF-700867-, pp 246-268) RESEARCH WORK CARRIED OUT AT THE TRIGA MAINZ REACTOR. Menke, H. (Johannes-Gutenberg-Univ., Mainz). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

The TRIGA-Mainz has been used for research work since the beginning of 1966. Investigation of mass- and charge distribution in nuclear fission is a dominating topic in the research work. Radiochemical separation methods were developed, which allowed separation of nuclides from the bulk of nearly 500 fission products of about 40 chemical elements. The separation methods were improved. Automatically operated fast chemical separation methods are used, which allow separation of single elements in several chemical steps within a few seconds' time. With the 250 MW pulse of the reactor, very short lived fission products are examined. The measurement of delayed neutron emission of fission products and nuclear spectroscopy of short lived nuclides were investigated. A 2 MV Cockcroft–Walton accelerator, producing a flux of nearly $10^{11}$ 14 MeV neutrons/cm$^2$-sec, was used since 1960 for irradiations with fast neutrons. Besides this research program, the reactor as well as the accelerator is used for activation analysis, both destructive and non-destructive. No commercial activation analysis service is maintained at the TRIGA Mainz. Other investigations are the search for the occurrence of superheavy elements in nature and fallout studies. (auth)

**2041** (CONF-700867-, pp 269-285) OPERATION, MAINTENANCE, AND UTILIZATION OF 250 kW TRIGA MARK II REACTOR AT THE INSTITUTE JOZEF STEFAN, LJUBLJANA, YUGOSLAVIA. Gabrovsek, Z.; Dimic, V.; Najzer, M. (Jozef Stefan Nuclear Inst., Ljubljana, Yugoslavia). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

At the Institute "Jozef Stefan" in Ljubljana the 250 kW TRIGA Mark II Reactor has been in operation since May 31, 1966. It is a steady state operated reactor without pulsing capabilities. The operational data, maintenance and utilization of the reactor are summarized for the first four years of reactor operation. (auth)

**2042** (CONF-700867-, pp 286-289) RECONSTRUCTION OF THE TRIGA BULK-SHIELDING EXPERIMENTAL TANK AT THE INSTITUTE "JOZEF STEFAN". Gabrovsek, Z.; Najzer, M.; Solinc, H. (Josef Stefan Nuclear Inst., Ljubljana, Yugoslavia). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

In 1969 the bulk-shielding experimental tank at the TRIGA Mark II Reactor in Ljubljana was reconstructed into a dry exposure room. The reasons for reconstruction, the description of the new exposure room and drawings are given. (auth)

**2043** (CONF-700867-, pp 290-305) RESEARCH ACTIVITIES AT THE FINNISH TRIGA LABORATORY. Jauho, P. (Helsinki Univ. of Tech., Otaniemi, Finland). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

A short description is given of the following projects: cold neutron facility redesign, texture studies with neutron diffraction, capture gamma ray studies for analytical purposes using Bi-filtered beam, neutron radiography, nuclear spectroscopy work, positron research, nuclear noise analysis, and activities of the reactor code group. The activities of the isotope technical division of the laboratory are described including neutron source based activation analysis, x-ray-fluorescence instruments for industrial use, tracer studies of industrial processes, labelling of compounds for medical use, and activation analysis applications. Some planned projects are mentioned. (auth)

**2044** (CONF-700867-, pp 308-339) GE AND ES DEVELOPMENTS IN TRIGA REACTOR DESIGN, FUEL, AND PERFORMANCE. McMain, A. T. Jr. (Gulf Energy and Environmental Systems, Inc., San Diego, CA). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

A review is given of the historic development of the various TRIGA facilities and fuel types. Particular attention is given to R & D efforts in the area of improved fuel designs and reactor facility designs including a summary of the current status in this area and projected future activities. Information of particular use to groups interested in increasing their performance and experimental capabilities is discussed. (auth)

**2045** (CONF-700867-, pp 340-346) AUTOMATIC PNEUMATIC TRANSPORT CONVEYER SYSTEM OF THE TRIGA-MARK I REACTOR OF MHH (MEDIZINISCHE HOCHSCHULE HANNOVER). Kalisch, H. (Gutehoffnungschuette Sterkrade AG, Ger.). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

A system is described for loading and removing irradiation samples into the Hannover TRIGA I reactor. The system combines a pneumatic rabbit system with a lazy susan with 40 specimen positions. (HDR)

**2046** (HEDL-SA-569) SIMULATION OF NEUTRON-INDUCED SWELLING IN FTR FUEL CLADDING. Laidler, J. J. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jun 1973. Contract AT(45-1)-2170. 18p. (CONF-730912-2). Dep. NTIS $3.00.

From international conference on physical metallurgy of reactor fuel elements; Berkeley, England, UK (2 Sep 1973).

A high voltage electron microscope is being used for the simulation of high neutron fluence swelling behavior of FTR fuel cladding, which is fabricated of 20% cold worked AISI Type 316 stainless steel. The fuel cladding is required to operate at temperatures up to 750°C and fluences as great as $1.3 \times 10^{23}$ n/cm$^2$ (E > 0.1 MeV). Simulation experiments have been conducted over the temperature range 400 to 600°C and to dose levels equivalent to neutron fluences of $5 \times 10^{23}$ n/cm$^2$ (E > 0.1 MeV). The HVEM simulation experiments have lead to a number of important conclusions regarding the expected behavior of FTR fuel cladding: saturation of swelling will not occur, and, in fact, should follow a linear law over the entire service lifetime; the beneficial effect of cold working will be retained to goal fluence, albeit with a slight reduction of efficiency with increasing fluence; and the amount of swelling will probably be less than 6% at goal fluence, representing an improvement relative to annealed material by a significant factor. (10 references) (auth)

**2047** (SLA-73-140) FAST BURST REACTOR NEUTRON TRANSPORT CALCULATIONS. Schmidt, T. R. (Sandia Labs., Albuquerque, N. Mex.). Sep 1973. Contract AT(29-1)-789. 70p. Dep. NTIS $5.50.

A series of neutron transport calculations are presented which were performed as a parametric analysis for the design of fast burst reactors. The information was generated for use in the design of SPR III, a new FBR to be built at Sandia Laboratories in Albuquerque, New Mexico. The parameters calculated include critical dimensions with various size irradiation cavities, the neutron spectra inside the cavity and external to the reactor, the neutron fluence in the cavity for a given energy deposition in the core, the fission density distribution in the fuel region, the static temperature coefficient of reactivity, reactivity worths of core separation and various types of experiments, and the reactivity worths of various reflector materials as a function of thickness and insertion trajectory. (auth)

**2048** (WARD-2171-26) FUEL PIN ENRICHMENT SPECIFICATIONS FOR FTR CORES 1 AND 2. Ramchandran, S.; Calamai, G. J.; Baloh, F. J.; Schellin, S. A. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Jan 1973. Contract AT(45-1)-2171. 151p. AT.

The final fuel pin enrichments using "clean" plutonium for the first two cores of FTR have been specified. The enrichment specification is essentially an optimization procedure involving such important parameters as safety, performance, and economics. In order to assure safe reactor operation, the chosen feed enrichments must provide a sufficient negative Doppler reactivity feedback. The performance oriented design requirements including core power output, peak neutron flux, cycle length, and steady state testing conditions must be attained. The average discharge burnup must be maximized consistent with the peak burnup limit. The fuel pin enrichments must provide sufficient excess reactivity to assure the reactor operation under nominal conditions. The major contributors to the excess reactivity requirement are: allowance for fuel depletion, power defects such as core expansion and Doppler coefficient, and the test loop loading variation. The total excess reactivity requirement is 9.27% $\Delta k/k$ which includes the 1 $\sigma$ uncertainty of 0.56% $\Delta k/k$. This assures an 84% confidence of meeting the actual excess reactivity requirements. The resultant final fuel enrichments (Pu/U + Pu) for the inner and outer zones are 22.43 w/o and 27.37 w/o, respectively. The zone enrichment ratio of 1.220 has been selected to maximize the core power. The fissile fuel content of the fully loaded core is 563 kg. The calculational details, the methods used, the input data and the evaluation of uncertainties for each of the reactivity requirements, and the final value of zone enrichments are included. (auth)

## Production and Materials Testing and Processing Reactors

*Refer also to abstracts 2021–2025, 2027–2032, and 2034–2044.*

**2049** (AERE-M-2454) USE OF SODIUM POLYPHOSPHATE AS A CORROSION INHIBITOR IN THE SECONDARY COOLING WATER CIRCUITS OF DIDO AND PLUTO REACTORS. Aitchison, G. F.; Smith, E. T. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). May 1971. 22p. Dep. NTIS (U. S. Sales Only) $3.25.

A brief review is presented of the use of sodium polyphosphate as a corrosion inhibitor and details are given of laboratory tests and plant trials on the secondary cooling-water circuits of DIDO and PLUTO reactors. It was confirmed that the corrosion rate of mild steel was reduced, but the treatment was discontinued because of fouling of the stainless-steel heat-exchangers by ferric phosphate. (auth)

**2050** (BNWL-CC-173) DECONTAMINATION STUDIES: BATTELLE NORTHWEST LABORATORIES, DECEMBER 1964–AUGUST 1965. Ayres, J. A.; Larrick, A. P.; Perrigo, L. D.; Weed, R. D. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 27 Jul 1965. 13p. (CONF-6509100-1). Dep. NTIS $3.00.

From ninth meeting of the USAEC reactor decontamination information exchange group; Washington, District of Columbia, USA (1 Sep 1965).

The decontamination activity described includes: laboratory studies to evaluate reagents, and actual decontamination of 2 steam generators at New Production Reactor. In laboratory tests, a proprietary oxalic acid solution appeared to be more effective than any other tried. No excessive corrosion was noted. Special reagents to dissolve high fired ceramic core materials ($UO_2$ and $PuO_2$) are being developed and evaluated. Phosphorous acid, sulfuric acid and a mixture of sulfuric and nitric acids were effective. Corrosion of 304 stainless steel was low. Two N Reactor steam generators were decontaminated to facilitate inspection and repair. The APSUL procedure was tried, but control of concentrations was inadequate and decontamination factors were low, ranging from 1.6 to 9.0. No excessive corrosion was noted. (auth)

## Propulsion and Package Reactors

*Refer also to abstracts 921 and 2082.*

**2051** (ANCR-1118) FLOWING GAS, NONNUCLEAR EXPERIMENTS ON THE GAS CORE REACTOR. Phase II Topical Report. Kunze, J. F.; Cooper, C. G.; Macbeth, P. J. (Aerojet Nuclear Co., Idaho Falls, Idaho). Jun 1973. Contract C-54558B. 82p. (NASA-CR-121191). Dep. NTIS $5.45.

For National Aeronautics and Space Administration, Washington, DC.

The second phase of work on flow tests conducted on models of the gas core (cavity) reactor is reported. Variations in cavity wall and injection configurations were aimed at establishing flow patterns that give a maximum of the nuclear criticality eigenvalue. Correlation with the nuclear effect was made using multigroup diffusion theory normalized by previous benchmark critical experiments. Air was used to simulate the hydrogen propellant in the flow tests, and smoked air or argon or freon to simulate the central nuclear fuel gas. Tests were run both in the down-firing and upfiring directions. Results showed that acceptable flow patterns with high volume fraction for the simulated nuclear fuel gas and high flow rate ratios of propellant to fuel can be obtained. Using a "point" injector for the fuel, good flow patterns are obtained by directing the outer gas at high velocity along the cavity wall, using louvered injection schemes. Recirculation patterns were needed to stabilize the heavy central gas when different gases are used. (auth)

**2052** (ANCR-1120) FEASIBILITY STUDY OF FULL-REACTOR GAS CORE DEMONSTRATION TEST. Kunze, J. F.; Lofthouse, J. H.; Shaffer, C. J.; Macbeth, P. J. (Aerojet Nuclear Co., Idaho Falls, Idaho). Jun 1973. Contract C-59718B. 68p. (NASA-CR-121190). Dep. NTIS $5.45.

For National Aeronautics and Space Administration, Washington, DC.

Separate studies of nuclear criticality, flow patterns, and thermodynamics for the gas core reactor concept have all given positive indications of its feasibility. However, before serious design for a full scale gas core application can be made, feasibility must be shown for operation with full interaction of the nuclear, thermal, and hydraulic effects. A minimum sized, and hence minimum expense, test arrangement for a full gas core configuration is examined. It is shown that the hydrogen coolant scattering effects dominate the nuclear considerations at temperature. A cavity diameter of somewhat larger than 4 ft (122 cm) will be needed if temperatures high enough to vaporize uranium are to be achieved. (auth)

**2053** EMISSION COEFFICIENT OF URANIUM PLASMAS. Schneider, R. T.; Campbell, H. D.; Mack, J. M. (Univ. of Florida, Gainesville). Nucl. Technol.; 20: No. 1, 15-26(Oct 1973).

The emission coefficient for uranium plasmas (temperature: 8000°K) was measured for the wavelength range from 1200 to 6000 Å. The results were compared to theoretical calculations and other measurements. Reasonable agreement between theoretical predictions and our measurements was found in the region from 1200 to 2000 Å. Although it was difficult to make absolute comparisons among the different reported measurements, considerable disagreement was found for the higher wavelength region. A short discussion regarding the overall comparisons is given, and final suggestions are made as to the most appropriate emission coefficient values to be used in future design calculations. The absorption coefficient for the same wavelength interval is also reported. 19 references. (auth)

**2054** MODEL OF THE DYNAMIC BEHAVIOR OF THE COAXIAL-FLOW GASEOUS-CORE NUCLEAR REACTOR. Turner, K. H. Jr.; Clement, J. D. (Georgia Inst. of Tech., Atlanta). Nucl. Technol.; 20: No. 1, 5-14(Oct 1973).

A mathematical model has been derived for the dynamic behavior of the coaxial-flow gaseous-core nuclear reactor system. The equations were derived from elementary neutron, heat, and mass balances on the components of the system, and from correlations presented in previous work. The system response for positive reactivity insertions, perturbations in the propellant and fuel flow rates at the cavity inlet, and for termination of the moderator primary coolant flow has been predicted. Present control technology can be invoked to control the reactor. 22 references. (auth)

## Reactor Safety and Environmental Aspects

*Refer also to abstracts 360, 363–368, 372, 373, 382, 386, 396, 397, 430, 431, and 435–438.*

**2055** (MRR-115(Vol. 1)) CREST SPECIALIST MEETING ON EMERGENCY CORE COOLING FOR LIGHT WATER REACTORS. Proceedings of a Conference Held in Garching/Munich, Germany, October 18–20, 1972. (Technische Universitaet Muenchen, Garching (West Germany). Laboratorium fuer Reaktorregelung und Anlagensicherung). Dec 1972. 527p. (CONF-721097-(P1)).

Problems related to emergency core cooling with emphasis on safety of light water reactors and recent experimental results are presented. Abstracts for fourteen papers have been prepared. (FS)

*For abstracts of individual papers see: 2056–2069.*

**2056** (MRR-115(VOL. 1), pp vp, 26p.) CURRENT STATUS OF ROSA PROGRAM. Shimamune, H.; Shiba, M.; Adachi, H.; Namatame, K.; Soajima, M. (Japan Atomic Energy Research Inst., Tokai). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1973).

The present status of an experimental program to obtain information on evaluating a system break using a large scale experimental facility is described. Purposes of the research program, the ROSA program, are (1) to measure the pressure and the leak flow transient during blowdown, (2) to perform a scoping experiment on DNB during blowdown, and (3) to validate computer codes, PIPRO and DEPCO developed for analysis of pressure oscillations in a system filled with a two-phase mixture of steam and water and with water respectively. Computer codes, RELAP2 and RELAP3, were released through the courtesy of the National Reactor Testing Station of the USAEC and are used as a part of the research activities. (GE)

**2057** (MRR-115(VOL. 1), pp vp, 16p.) EXPERIMENTAL BLOWDOWN STUDIES OF A REACTOR SIMULATOR VESSEL CONTAINING SIMPLIFIED INTERNALS. Ruediger, B. (Battelle-Institut, Frankfurt am Main). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1973).

Experimental results from studies on the discharge process after rupture of a main coolant pipe in a water cooled reactor are used to investigate the hydrodynamic and thermodynamic processes involved using a digital computer. (FS)

**2058** (MRR-115(Vol. 1), pp vp, 30p.) FULL SCALE SAFETY EXPERIMENTS OF FUGEN. Tokumitsu, M. (Power Reactor and Nuclear Fuel Corporation, Oarai, Japan). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1973).

Reactor safety experiments carried out at FUGEN, the heavy water moderated boiling light water cooled reactor, are presented to evaluate accidents of primary cooling pipes and main steam pipeline ruptures to clarify the characteristics of blowdown in the primary cooling system and to confirm the core cooling effect in ECCS in blowdown accidents. (FS)

**2059** (MRR-115(VOL. 1), pp vp, 39p.) STUDY OF HEAT TRANSFER DURING THE REFLOODING OF A SINGLE ROD TEST SECTION. Andreoni, D.; Courtaud, M. (CEN, Grenoble, France). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1973).

Preliminary experiments examined the rewetting of a single rod at atmospheric pressure. Further studies with an experimental set-up actually under construction will investigate the rewetting of a tube and of a 25-rod bundle at pressures up to 6 bars to establish physical models and correlations of heat transfer to be used in computer codes which will predict the evolution of cladding temperature during the reflooding phase. To facilitate interpretation of the results some parameters such as pressure, heat generation, and flooding rate, are kept constant. Results concerning the rewetting of single rods at atmospheric pressure are presented. (GE)

**2060** (MRR-115(VOL. 1), pp vp, 48p.) EXPERIMENTS ON THE COOLING OF HIGH-TEMPERATURE SURFACES BY WATER JETS AND DROPS. Duffey, R. B.; Porthouse, D. T. C. (Berkeley Nuclear Labs., Eng.). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1973).

Visualisation experiments on a heated rod bundle with direct water spray injection using an axial sparge pipe are described. The dominant heat removal mechanism distant from the injection point is associated with the production and motion of water droplets. Using water jets impinging on single rods, measurements were made of the droplet production efficiency and rod rewetting characteristics to 750° C temperatures for large variations in jet flow. The production of an aerosol from behind advancing wetting patches was demonstrated. Measurements were made of the temporal and spatial variations of heat flux and the heat transfer coefficient for water jets and droplets impinging on flat plates. The results are discussed in terms of a qualitative model for within-cluster spray cooling. (GE)

**2061** (MRR-115(VOL. 1), pp vp, 32p.) LOW RATE EMERGENCY REFLOODING HEAT TRANSFER TESTS IN ROD BUNDLE. Campanile, A. (FIAT-SORIN, Turin, Italy); Pozzi, G. P. Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1973).

The possibility of cooling a PWR rod bundle with low reflooding velocity, in the range of 0.2 to 0.6 in./sec, was examined. Results have some limitations from the standpoint of their applicability to the loss of coolant reflooding analysis of an actual large PWR core. However, the same results seem to indicate that reflooding a PWR core with reflooding velocities smaller than 0.6 in./sec does not represent an uncoolable situation, in a sense that a relationship between every flooding velocity and the corresponding maximum acceptable power exists. (FS)

**2062** (MRR-115(VOL. 1), pp vp, 36p.) ECC-REFLOODING EXPERIMENTS WITH A 340-ROD BUNDLE. Riedle, K.; Winkler, F. (Siemens AG, Erlangen, Ger.). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1973).

The performance of the low-pressure ECCS used in some PWRs was investigated. Fluid flow and heat transfer data during reflooding and simulated LOCA conditions were obtained. Experimental data will be reduced to provide information on heat transfer coefficients, rewetting velocity, and pressure buildup. Tests with completely blocked steam discharge from the upper plenum show that the hot leg injection is capable of condensing all the steam formed in the bundle during reflood. (FS)

**2063** (MRR-115(VOL. 1), pp vp, 59p.) BOTTOM FLOODING EXPERIMENTS WITH SIMPLE GEOMETRIES UNDER DIFFERENT ECC CONDITIONS. Martini, R.; Premoli, A. (CISE Segrate, Milan). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1973).

Experimental investigations of power channel thermal transients following cold water injection into the channel bottoms.under ECCS conditions are presented. Results are compared with the analytical model which predicts ECCS transients in bottom flooding conditions. (FS)

**2064** (MRR-115(VOL. 1), pp vp, 25p.) INVESTIGATIONS ON FUEL ROD FAILURE DURING A LOSS-OF-COOLANT ACCIDENT IN CONSIDERATION OF ECCS-CRITERIA. Class, G.; Fiege, A.; Fischer, M.; Hofmann, G.; Karb, E.; Leistikow, S. (Kernforschungszentrum, Karlsruhe, Ger.). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1973).

Fuel rod failures during a LOCA are investigated, focused on the thermal and mechanical conditions of the fuel rod at the end of blowdown, interaction between heat transfer and plastic clad deformation, mechanisms and extent of fuel rod failure during refill and reflood, mode of fuel rod failure (ductile or brittle), and the consequences of fuel rod failure with respect to ECCS. (FS)

**2065** (MRR-115(VOL. 1), pp vp, 8p.) TRANSIENT BOILING HEAT TRANSFER OF WATER AT THE VERTICAL WALL OF A REACTOR PRESSURE VESSEL. Hufschmidt, W.; Burck, E. (EURATOM, Ispra, Italy). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1973).

Results of studies of transient temperature distribution and the resulting thermal stresses in the thick wall of a reactor pressure vessel flooded with water at atmospheric pressure from the ECCS are presented. (FS)

**2066** (MRR-115(VOL. 1), pp vp, 30p.) EXPERIMENTAL BASIS FOR BWR EMERGENCY CORE COOLING. Imhoff, D. H.; Murray, J. L. (General Electric Co., San Jose, CA). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1973).

The extensive development work on ECCS of the BWR, carried out by GE is discussed consisting of: high-pressure core spray (HPCS), low-pressure core spray (LPCS), three low-pressure coolant injection (LPCI), and the automatic relief system (ARS). The HPCS protects against small breaks and depressurizes the reactor so that the LPCS and LPCI water can enter. The ARS provides backup depressurization if the HPCS does not come on. The LPCI delivers a large flood of water into the core to quickly refill the vessel. With this ECCS network the BWR is protected by three independent coolant systems and two phenomena, spraying and flooding, over the full spectrum of LOCA conditions. (GE)

**2067** (MRR-115(VOL. 1), pp vp, 44p.) DRYOUT ONSET IN FLOW STOPPAGE, DEPRESSURIZATION, AND POWER SURGE TRANSIENTS. Gaspari, G. P.; Granzini, R.; Hassid, A. (CISE-Segrate, Milan). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1973).

Emphasis was given to the problem of dryout onset by making measurements during each experienced transient of the instantaneous mass balance over the power channel by means of the quick-acting valve technique. The dryout experiments were carried out under the following conditions: steady state; inlet flow stoppage, constant power and pressure transients; inlet flow stoppage, constant generated power and rapid depressurization transient; and constant inlet flow and pressure, power surge. The heated section was an externally heated annulus (ID = 1.35 cm; OD = 2.1 cm; L = 400 cm). The initial pressure was approximately 50 bars. The main experimental data are presented and discussed with a view to finding a reliable method for linking the steady-state to transient dryout results. (GE)

**2068** (MRR-115(VOL. 1), pp vp, 27p.) HEAT TRANSFER DURING BLOWDOWN WITH AN INSIDE COOLED TUBE AS TEST SECTION. Hicken, E.; Koch, E.; Schad, O. (AEG Telefunken, Frankfurt am Main). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1972).

A general outline of the test facilities, the experimental program and the measurement techniques are presented. The inside cooled tube experiments are described. Special care is taken to indicate existing experience from the blowdown experiments and to show the problems which should be tackled with highest priority. Results of the inside cooled tube experiments are presented. (GE)

**2069** (MRR-115(Vol. 1), pp vp, 24p.) EXPERIMENTAL INVESTIGATION OF THE POST CRISIS HEAT TRANSFER IN A COOLING SUB-CHANNEL OF A PWR DURING DEPRESSURIZATION. Friz, G.; Riebold, W. (EURATOM-CCR, Ispra, Italy). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1972).

The calculation of the temperature developed in the fuel cans caused by a primary coolant circuit rupture in a PWR was studied. The special loop used is described. The electric power supply provides for the simulation of the decreasing heat input from the fuel to the can which with the heat transfer to the coolant determines the temperature time curve of the can. Results of the measurements are shown graphically. (FS)

**2070** (MRR-115(VOL. 2.)) CREST SPECIALIST MEETING ON EMERGENCY CORE COOLING FOR LIGHT WATER REACTORS. Proceedings of a Conference Held in Garching/Munich, Germany, October 18-20, 1972. (Technische Universitaet Muenchen, Garching (West Germany). Laboratorium fuer Reaktorregelung und Anlagensicherung). Dec 1972. 455p. (CONF-721097-(P2)).

Recent experimental results provide a review of the current status of problems related to the emergency core cooling of light water reactors. Fourteen separate abstracts have been prepared. (FS)

*For abstracts of individual papers see: 2071—2084.*

**2071** (MRR-115(VOL. 2), pp vp, 12p) APPLICATION OF THE DIGITAL COMPUTER CODE BRUCH-D ON BLOWDOWN EXPERIMENTS WITH ELECTRICALLY HEATED INSIDE COOLED TUBE. Vojtek, I. (Technische Univ., Munich). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1972).

The application of the BRUCH-D 7-node version to the calculation of blowdown experiments with electrically heated, inside cooled tubes (performed by EURATOM in Ispra on the DHT-1 experimental loop) is described. Calculated and measured results are compared. The purpose of calculation was not only to compare measured and calculated results but also to find out difficulties in connection with the application of BRUCH-D to a scaled experimental loop. The calculations show that scaled systems with practically the same values of pressures and enthalpies but with strongly reduced values of mass and mass flows (compared to an actual PWR) are very sensitive to the accuracy of numerical integration and require reduction of the time step size mainly during the subcooled phase of depressurization. The use of a new implicit numerical integration method with an improvement for the integration of intervals containing nondifferentiable points, which was developed for the code BRUCH-D, has reduced the difficulties connected with instability and has made it economically feasible to perform complete blowdown analysis. The agreement between experiment and calculation is good. (GE)

**2072** (MRR-115(VOL. 2), pp vp, 29p.) REMI/HEAT COOL: COMPUTER PROGRAMME FOR CALCULATION OF CORE HEAT UP WITH SPRAY COOLING. Andersen, J.; Abel-Larsen, H. (Danish Atomic Energy Commission, Risoe). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1972).

REMI/HEAT COOL is a computer programme for calculation of core heat up transients. The code determines the temperature transient of the fuel, and evaluates the influence of ECC, i.e., spray cooling. REMI/HEAT COOL is based on separate description of the steam and water phase in the primary system, and a detailed description of the radiative heat transfer between the fuel rods and the shroud. The latter does involve a determination of the absorption of thermal radiation in the two-phase flow. Furthermore, the programme considers the decay heat, metal-water reaction, heat transfer due to conduction and convection, and the film flow on rods and shroud. (GE)

**2073** (MRR-115(VOL. 2), pp vp, 33p.) ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER DURING SIMULATED COLD-LEG BLOWDOWN ACCIDENTS. Morgan, C. D. (Babcock and Wilcox Co., Lynchburg, VA); Roy, D. H.; Hedrick, R. A.; Stoudt, R. H.; Zielke, L. A.; Gellerstedt, J. S. Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1972).

The results of analytical and experimental investigations for blowdown heat transfer and ECC fluid entrainment are presented in detail. The evaluation model (CRAFT code, REFLOOD code, THETA 1-B) is summarized and used to contrast system LOCA response for both "bounding" and "predictive" assumptions for various blowdown phenomena. Results of recent cold-leg break simulations using the Boiling Heat Transfer Loop are presented to demonstrate that boundary-layer controlled, steady-state heat transfer models for the cooling process during rapid depressurization and oscillatory flow conditions are highly conservative. Results of CRAFT code analyses of loop response are reported and show that the use of steady-state CHF correlations greatly underestimate time to "DNB". The thermodynamic equilibrium and non-equilibrium options in the CRAFT code have been used in combination with a critical velocity analysis of the different phenomena which contribute to ECC fluid rejection to investigate the ECC bypass problem. Results are presented and contrasted with results obtained using the AEC-approved evaluation model with its 100% bypass constraint. (GE)

**2074** (MRR-115(VOL. 2), pp vp, 18p.) TILT: A DIGITAL SIMULATION PROGRAMME FOR THE STUDY OF HYDRODYNAMIC PROCESSES AND CORE HEAT-UP OF A BOILING WATER PRESSURE TUBE REACTOR DURING TRANSIENT CONDITIONS. Magni, A. (CISE, Milan). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1972).

The TILT digital program was written to simulate the nuclear, thermal, and hydrodynamic behavior of the CIRENE plant during transient conditions resulting from process perturbations and accidents. TILT is also able to consider different channel geometries. The plant schemes considered in the program include the most important components of the heat transport primary circuit with its auxiliary control and safety systems. The physical-analytical description uses a lumped parameter scheme with local thermodynamic equilibrium and space/time dependent slip ratio; furthermore, this model deals with dryout and transient heat transfer, thus allowing for an investigation of such conditions. The computed coolant mass content and pressure transients are in good agreement with blowdown experimental measurements. The code is written in FORTRAN V for UNIVAC-1108 computer. (GE)

**2075** (MRR-115(VOL. 2), pp vp, 13p.) SMALL BREAK LOSS OF-COOLANT ACCIDENT. Longo, J. Jr.; Kern, R. C. (Combustion Engineering, Inc., Windsor, CT). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1972).

Small break (breaks below $0.5\ ft^2$) LOCAs with multi-node representations of the primary coolant system were studied. These studies show significant differences between the results of single vs multi-node representations. Because the pressure differentials in the small break LOCAs are indeed small, the gravity effects thus become predominant and affect the degree of cooling significantly by controlling the flow direction. The multi-node small break results are presented and the differences one might expect between the different nodal representations are illustrated. Investigations of blowdown models for small break LOCAs have established the following: a) hydrostatic forces play an important role in determining the core recovery characteristics and, hence, the resulting clad temperatures, b) the use of a single-node blowdown model is not adequately conservative, c) adequate modeling of the plant physical hardware is an important consideration, and d) caution must be exercised in modeling regions of the primary system which are influential in establishing the core recovery characteristics. (GE)

**2076** (MRR-115(VOL. 2), pp vp, 16p.) INFLUENCE OF PRIMARY CIRCUIT COMPONENTS OF A PWR ON THE ANALYSIS OF MASS FLOW RATES THROUGH THE CORE. Liesch, K. J. (Technische Univ., Munich). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1972).

A parametrical study was made to investigate different influences on mass flow rates through the core. The following cases were calculated using the BRUCH-D code; Base case. In general data for a modern PWR is used. The following assumptions are made: a) double-end break of the cold leg between the pump and the pressure vessel, b) critical mass flow rates based on the Moody model, c) heat transfer coefficient as a function of time will be given as input data, and d) the pumping head drops to zero during cavitation. If the pressure of the primary side of the steam generators decreases below the pressure of the secondary side, heat is transferred from the secondary to the primary side. Simulation of the pumps: a) the pumps are working at full capacity till the end of the blowdown, b) the pumps are assumed to be flow resistant by introducing negative driving heads. Simulation of the steam generators: a) the steam generators are heat sinks over the entire transient which means that the pressure of the secondary loop decreases, b) the heat sinks are removed, therefore no heat is taken out of the primary loop. The pressurizer is connected to different nodes. Stored heat from the structural materials is added to several nodes. (GE)

**2077** (MRR-115(VOL. 2), pp vp, 14p.) PREDICTION OF FORCES ON PRESSURIZED WATER REACTOR VESSEL INTERNALS FOLLOWING A LOSS OF COOLANT ACCIDENT. Watzinger, H.; Gruber, P.; Winkler, F. (Siemens AG, Erlangen, Ger.). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1972).

An analysis was performed to determine transient forces resulting from coolant pressure and flow oscillations by using the KRAFT-code, a more sophisticated version of the BRUCH-program During the period of blowdown, in which the coolant is in the subcooled regime, slight coolant volume changes will result in large pressure changes, as is evident from a T-S-diagram. Therefore, by modifying the BRUCH-code the consideration of variable coolant volumes (nodes), as a result of elastic and plastic deformation of the reactor internals, was introduced. Application of the modified basic equations to the lumped system of the blowdown model (15 nodes are used) results in a system of linear algebraic equations which can be solved for the time derivatives of pressure. Then the forces are calculated by using the impulse equations to control volumes surrounding the desired components. The described version of the KRAFT-code was applied to some double-ended ruptures of a primary coolant pipe after a total break of the cold leg between the pump and vessel inlet. In this case, a high pressure difference builds up over the surface of the core barrel resulting in a large deformation in the region of the inlet nozzles. Forces on the lower core support, fuel assembly, upper grid plate and upper support are illustrated and compared with the results of the model with constant node volumes. (GE)

**2078** (MRR-115(VOL. 2), pp vp, 13p.) FUEL ELEMENT INTEGRITY AND BEHAVIOUR IN A LOSS OF COOLANT ACCIDENT. Baker, J. N. (British Nuclear Design and Construction Ltd., Whetstone, Eng.). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1972).

The work done by determining the relevant fuel failure limits, namely clad bursting in the depressurized reactor condition due to internal fission gas pressure and, using the available clad rupture data for Zircaloy and stainless steel, assesses the probability of failure at the conditions of peak clad temperature and internal gas pressure existing for all pins in a PWR reactor at the various stages of fuel life. The effects of varying certain fuel parameters are also covered to illustrate their effects on element integrity. The analysis illustrates the effect of different assumptions of available heat transfer from the emergency cooling water system and different mathematical models of the temperature transients on the number of fuel pins liable to fail. The limitations of the available materials data and analytical methods used are discussed and the effect of uncertainties in these areas is assessed for the two fuel clad materials chosen. (GE)

**2079** (MRR-115(VOL. 2), pp vp, 11p.) CLADFLOOD: AN ANALYTICAL METHOD OF CALCULATING CORE REFLOODING AND ITS APPLICATION TO PWR LOSS OF COOLANT ACCIDENT. Goldemund, M. H. (British Nuclear Design and Construction Ltd., Whetstone, Eng.). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1972).

The application and shortcomings of FLECHT data and its use for analysis of postulated PWR loss of coolant accidents are briefly discussed. FLECHT heat transfer data was correlated by means of a modified Ellion equation for stable film boiling. The modification gave a new correlation for transition boiling heat transfer based on local properties. The reasons for requiring a heat transfer coefficient based on local coolant properties instead of the FLECHT heat transfer equations are outlined. The transition boiling heat transfer equation was built into "CLADFLOOD", a newly developed computer code for estimating fuel-clad temperature behavior during the core reflooding process. The methods of calculation in "CLADFLOOD" are described briefly and FLECHT computer simulation runs using "CLADFLOOD" are compared with data from actual FLECHT tests. "CLADFLOOD" was then used for a PWR core reflooding analysis. The effects of various parameters such as number of emergency cooling pumps, accumulator injection time, initial clad temperature, axial power distribution, and fuel rating were investigated and some results are presented for discussion. (GE)

**2080** (MRR-115(VOL. 2), pp vp, 24p.) SIMULATION OF STEAM FLOW PROCESSES DURING THE REFILLING PHASE OF A PWR. Brosche, D.; Grosserichter, R. (Technische Univ., Munich). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1972).

The new computer code NOWA, which is described simulates the steam flow behavior in the pressure vessel and in the different loops of a pressurized water reactor after the blowdown phase of a loss-of-coolant accident during the emergency core cooling low pressure and refilling phase. NOWA is a multi-node model which investigates the space and time dependent distributions of pressures, temperatures, mass flow rates, and velocities of the steam flow within the whole primary system taking into account, in a simplified manner, condensation effects of the steam in the cold injected water and heat release from hot structures. (GE)

**2081** (MRR-115(VOL. 2), pp vp, 19p.) SIMPLE MODEL FOR PREDICTING ECC TRANSIENTS IN BOTTOM FLOODING CONDITIONS. Martini, R.; Premoli, A. (CISE, Milan). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1972).

On the basis of information and literature data, a simple and preliminary computation model of the thermal-hydraulic transients of fuel elements in ECC bottom flooding conditions has been developed. The model describes the behavior of single rods, on the basis of a heat coefficient correlation in film-boiling which has been derived from ECC experimental literature data in the film boiling regime. The quenching mechanism is represented by assuming an instantaneous drop of the surface temperature to the saturation temperature as soon as the surface temperature at a given node reaches a prefixed value ("quenching temperature"). The simplifying assumptions involved in the heat transfer correlation and in the quenching mechanism are tested against some experimental data with satisfactory results. The model has been programmed in FORTRAN IV language. (GE)

**2082** (MRR-115(VOL. 2), pp vp, 16p.) DESIGN OF EMERGENCY CORE COOLING SYSTEMS IN NUCLEAR SHIP REACTORS. Mink, I. F. J. (Reactor Centrum Nederland, Petten). Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1972).

Requirements that are necessary as a basis for the design of engineered safeguards, especially the safety injection system, are formulated for two PWR designs: a loop type and an integral type. In addition some calculations have been performed concerning the temperature-time history of the cladding in the design basis accident situation. As a result actual solutions are given for the safety injection systems in both designs. Relatively simple systems with a minimum of additional equipment are proposed. (GE)

**2083** (MRR-115(VOL. 2), pp vp, 11p.) JAPANESE SAFETY EXAMINATION CRITERIA ON ECCS. Uchida, H. (Tokyo Univ.); Kodama, K. Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Pct 1972).

A history of ECCS study, the situation of power plant development, examination criteria on the ECCS, and some examination examples by the criteria in Japan are presented. (GE)

**2084** (MRR-115(VOL. 2), pp vp, 36p.) WESTINGHOUSE PWR-ECC SYSTEM. Cermak, J. O. Dec 1972.

From CREST specialist meeting on emergency core cooling for light water reactors; Garching, Germany (18 Oct 1972).

The ECC system described is designed to deliver cooling water to the reactor core in a loss-of-coolant accident resulting from a pipe rupture up to and including the double ended failure of a main cooling system pipe. The system, consisting of pressurized accumulators and high and low pressure pumps, ensures that essential heat transfer geometry is preserved in the core. (FS)

**2085** (ORNL-TM-4331) LMFBR SAFETY AND CORE SYSTEMS PROGRAMS PROGRESS REPORT FOR MAY–JUNE 1973. Fontana, M. H. (Oak Ridge National Lab., Tenn. (USA)). Oct 1973. Contract W-7405-eng-26. 83p. AT.

Experiments performed in the FFM facility are described. Temperature distributions and flow characteristics in fuel bundles with partial blockage are measured. The development of electric heaters for the FFM facility is described. (DCC)

**2086** (WCAP-7921) DAMPING VALUES OF NUCLEAR POWER PLANT COMPONENTS. Morrone, A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Nov 1972. 83p.

Damping values and data from various tests of nuclear power plant components and other structures are presented and evaluated. A description of the damping determinations is given along with recommended damping values for primary coolant loop components, piping and other structures. The results show that, in general, damping increases with the magnitude of excitation and the resulting stress levels. It is shown that system damping, which is considered as the predominant damping mechanism for primary coolant loop components, yields damping values higher than those being currently used. (auth)

**2087** PHYSICS OF REWETTING IN WATER REACTOR EMERGENCY CORE COOLING. Duffey, R. B.; Porthouse, D. T. C. (Central Electricity Generating Board, Gloucestershire, Eng.). Nucl. Eng. Des.; 25: No. 3, 379-394(1973).

Surface rewetting is essential for the re-establishment of normal and safe temperature levels following dryout in rod clusters or boiler tubes, or following postulated loss-of-coolant accidents in water reactors. Rewetting experiments have been performed with tubes and rods with a wide range of materials and experimental conditions (surface temperatures 300 to 800°C, constant water flows 0.1 to 30 g $s^{-1}$). The physical processes involved in the rewetting of high temperature surfaces have been shown to be identical for both falling water films and bottom flooding. The variation of rewetting velocity with mass flow has been determined, and shown to be independent of hydraulic diameter over the range 0.2 to 6 mm of practical interest. Data have also been obtained on the mass "carryover" fraction. Theoretical solutions for the rewetting velocities have been obtained by analysis of thermal conduction in the surface. At low mass flows, effectively one-dimensional (axial) conduction cools the surface ahead of the rewetting front, and gives agreement with experiment. At higher mass flows the rewetting velocity is substantially independent of surface thickness and conductivity. The present data and the available world data for rewetting are shown to be in agreement with the theory. 20 references. (auth)

**2088** CONSIDERATIONS ABOUT THE RELIABILITY OF NUCLEAR PRESSURE VESSELS STATUS AND RESEARCH PLANNING. Kellermann, O. (Technischer Ueberwachungs-Verein, Cologne); Kraegeloh, E.; Kussmaul, K.; Sturm, D. pp 25-38 of Second International Conference on Pressure Vessel Technology. I. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P1.

The Research Program Reactor Safety of the government of the Federal Republic of Germany (FRG) consists of two subprograms: "Accidents and Engineered Safeguards" and "Improvement of Operational Safety". A Status Report Reactor Pressure Vessels (RPV) shall analyze the situation in the field of pressure vessels of light water reactors (LWR) and thus provide a basis for research planning. At the end of 1972 a research project "Priority Program 22 NiMoCr 37" has been initiated. Prior to other activities, it is expected to yield information on special welding problems. Nonoptimal fabrication conditions may cause incipient cracks and/or decreased toughness in plates and forgings. Incipient cracks in the heat affected zone (HAZ) of connecting welds, as have been observed, represent a particular problem. The open boundary conditions in the practical application of fracture mechanics technology consist of the exact determination of critical states in the material and, also, in the evaluation of special types of cracking and of residual stresses. (auth)

**2089** SAFETY FOR THE PERSONNEL AND THE POPULATION IN THE OPERATION OF NUCLEAR POWER PLANTS. 1. Kley, H. (Brown, Boveri und Cie AG, Mannheim, Ger.). Sicherheitsingerieur; 2: No. 1, 10-13(1971). (In German).

The most important technical and construction principles and safety aspects of the construction of modern, commercially available nuclear reactor types in heavily populated areas are summarized. (GF)

## Reactor Theory and Calculation

**2090** (AERE-R-7363) CROSS-SECTION FOR THE PRODUCTION OF $^{242}$Cm FROM $^{241}$Am IN A FAST REACTOR. Wiltshire, R. A. P.; Willis, H. H.; Rogers, F. J. G.; Glover, K. M.; Cuninghame, J. G.; Sweet, D. W. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Jul 1973. 19p. Dep. NTIS (U.S. Sales Only) $3.00. UK 50 pence.

Three samples of purified $^{241}AmO_2$ were irradiated in ZEBRA. The composition of the core, and therefore the neutron spectrum in which the irradiations took place, was a close match to that of a commercial fast power reactor. The $^{242}$Cm produced in the samples was estimated by $\alpha$-counting, as was the amount of $^{241}$Am irradiated. From the results the production cross-section for $^{242}$Cm from $^{241}$Am was found to be 1.50 ± 0.09 barns. (auth)

**2091** (DP-MS-73-37) DIRECT ITERATIVE CALCULATION OF TRANSIENT NEUTRON FLUX STATES FOR THREE-DIMENSIONAL HEXAGONAL LATTICES. Stewart, J. W.; Buckner, M. R. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1973. 16p. (CONF-731101-15). Dep. NTIS $3.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum and Nuclear Energy Exhibition; San Francisco, California, USA (11 Nov 1973).

A direct, iterative method has been developed for the numerical solution of the transient few-group diffusion equation and the delayed neutron precurser equation in three-dimensional hex-z geometry. The solutions to the transient and static calculations agree within 0.1%. This method is incorporated as a JOSHUA module at the Savannah River Laboratory. (auth)

**2092** (GEAP-13771-7) CRITICAL EXPERIMENTS AND COOPERATIVE EVALUATIONS PROGRAM SEVENTH QUARTERLY REPORT, APRIL-JUNE 1973. (General Electric Co., Sunnyvale, Calif. Breeder Reactor Dept.). June 1973. Contract AT(04-3)-893. 56p. Dep. NTIS $5.45.

Current activities and technical progress for the period April through June 1973 are reported for two subtasks. Subtask A covers the planning and analysis of critical experiments in ZPPR-3. Subtask B progress is reported for nuclear data evaluation and testing and methods development in support of Subtask A. (auth)

**2093** (ORNL-TM-4197) FISSION-PRODUCT AFTERHEAT: A REVIEW OF EXPERIMENTS PERTINENT TO THE THERMAL-NEUTRON FISSION OF $^{235}$U. Perry, A. M.; Maienschein, F. C.; Vondy, D. R. (Oak Ridge National Lab., Tenn.). Oct 1973. Contract W-7405-eng-26. 97p. Dep. NTIS $7.00.

Experimental data relating to beta and gamma energy release rates following thermal-neutron fission of $^{235}$U are reviewed. An afterheat function based on these experiments, for after-shutdown times from 1 s to $5 \times 10^5$ s, is proposed and compared with the proposed ANS Standard ANS-5.1; and the uncertainty in the function proposed here is estimated. This proposed function varies between 0.98 and 1.08 times the proposed standard function; the standard deviation is estimated to be between 10% and 15%. (31 figures, 17 tables, 48 references) (auth)

**2094** NON-LINEAR LEAST SQUARES METHODS FOR PARAMETER ESTIMATION, WITH APPLICATIONS IN REACTORS PHYSICS. Wood, J. (Queen's Mary Coll., London). J. Inst. Nucl. Eng.; 14: No. 4, 106-110; 113-121(Jul 1973).

A review is presented of the algorithms that are available for fitting (weighted) experimental data to non-linear functions by the Method of Least Squares. The methods are considered as belonging to three categories: the Gauss Newton Method, or a variant; Gradient (or Search) techniques; Compromise Techniques. The basic features of the more important methods belonging to these categories are described. Detailed results are given of applying various methods to 9-test functions which are of particular interest to reactor physicists. A table is included which compares the performances of the algorithms in terms of the number of iterations and function evaluations required to solve the numerical examples. (auth)

## Reactor Components and Accessories

*Refer also to abstracts 254, 257–261, 325–329, 331–335, 948, 949, and 984.*

**2095** PRESTRESSED CONCRETE REACTOR VESSELS FOR NUCLEAR POWER PLANTS COMPARED TO THICK-WALLED AND MULTILAYER STEEL VESSELS. Fuerste, W.; Hohnerlein, G.; Schafstall, H. G. (Fried. Krupp Maschinenfabriken, Essen). pp 485-498 of Second International Conference on Pressure Vessel Technology. I. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P1.

All types of power reactors began their development using steel pressure vessels. Increasing pressures and core geometries of high power stations showed the technical limits of the thick-walled steel pressure vessels and induced the introduction of the prestressed concrete reactor vessel (PCRV) for gas cooled reactors. Especially for this type of reactor the PCRV has reached a high level in design and operation. After the phase of experiments with various types, the vertical type with pod boilers proved to be the best technical and economical solution. The PCRV is also under development for water reactors in several countries. The results of research proved that this type of vessel is applicable to light water reactors, too. With reference to the increasing safety standards for nuclear power plants in high populated areas, especially in Europe, the PCRV also proved to be more economical than the thick-walled steel pressure vessel. Also the multilayer steel vessel shows economic advantages because of entire construction on site and the low fabrication risk. The technical and economical results of our research on the PCRV, the thick-walled, and multilayer steel vessels are qualitatively compared. (auth)

**2096** RECENT DEVELOPMENT IN NUCLEAR PRESTRESSED CONCRETE PRESSURE VESSELS IN FRANCE. Costes, D.; Riquois, R.; Lacroix, R. (CEN, Saclay, France). pp 499-509 of Second International Conference on Pressure Vessel Technology. I. New York; American Society of Mechanical Engineers (1973).

From 2nd international congress for pressure vessel and piping technology; San Antonio, Texas, USA (1 Oct 1973). See CONF-731003-P1.

Experience in France in the use of prestressed concrete pressure vessels (PCPV's) for gas-cooled reactors, such as the Marcoule built in 1956-57, is reviewed by considering the special characteristics of PCPV's, resistance of PCPV's to accidents, and official regulations related to such pressure vessels. Research results are presented on: materials testing to determine the mechanical properties of prestressed concrete and special high-strength concrete, requirements for insulating concretes used in the hot liner concept of pressure vessel construction, and corrosion testing of concretes for pressure vessels. Finally special design features of Rebecca-C, a boiling water reactor with a PCPV, are itemized. (LCL)

## Reactor Fuels

*Refer also to abstracts 286, 915, 916, 918, 920, 922, 938, and 940.*

**2097** (ANL-8028) DEVELOPMENT OF A MECHANICAL MODEL OF IN-REACTOR FUEL BEHAVIOR: STATUS REPORT. Roberts, J. T. A.; Routbort, J. L.; Voglewede, J. C.; Solomon, A. A. (Argonne National Lab., Ill). Jul 1973. Contract W 31-109-Eng-38. 30p. AT.

The status of the program to develop a mechanical model of in-reactor fuel behavior is reported. The subroutines CREEF, SWELL, and CRACK in the LIFE-II fuel-performance code are updated to include the latest mechanical-property data on (U, Pu) mixed oxides. Improved fuel hot-pressing and cracking models are introduced into SWELL and CRACK, respectively. A parametric study conducted with the revised version of LIFE-II shows the sensitivity of code predictions (cladding stress history, fuel restructuring, and fuel-cladding-gap closure) to fuel plasticity and, in particular, the magnitude of the fuel densification component. Recommendations are made for additional improvements in the LIFE-II mechanical analysis. Programs are outlined to develop improved fuel behavior from the standpoint of both steady-state performance and behavior during reactor transients. (auth)

**2098** (BNWL-1778) GAPCON-THERMAL-1: A COMPUTER PROGRAM FOR CALCULATING THE GAP CONDUCTANCE IN OXIDE FUEL PINS. Hann, C. R.; Beyer, C. E.; Parchen, L. J. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1973. Contract AT(45-1)-1830. 235p. Dep. NTIS $7.60.

GAPCON-THERMAL-1, a modification of GAPCON, can be used to calculate the gap conductance and fuel temperatures in oxide fuel pins. The code in its current form was developed for the Regulatory Staff who use the code as a tool to independently calculate gap conductances for understanding various thermal performance models supplied by fuel venders. The code is capable of calculating fuel temperatures for several coolant, cladding, and fuel material combinations. Changes in the diametral gap width are modeled. The source of these changes include differential thermal expansion of pellet and cladding, elastic and creep deformation of cladding, fission product expansion of the pellet, and fuel expansion induced by cracks and subsequent thermal ratcheting. In addition to the gap changes, the code simulates a variety of fill gas compositions and changes to the gas composition caused by the release of fission gap and volatile impurities. Comparisons of calculations and experimental data indicate fuel temperatures are predicted reasonably well for short term irradiations and small gaps. The disagreement between predictions and experimental data is roughly proportional to the gap width and the calculated values are typically higher than the experimental values. Fuel temperature calculations for extended periods of irradiation become more uncertain because of inadequacies in the code and the dearth of well characterized data. These inadequacies are related principally to the kinetics of gap closure and fission gas release. On-going work is focused on reducing the uncertainty in these two areas of the code and in other areas of somewhat lesser significance. The effects of these uncertainties on the fuel stored energy are offset somewhat by the reduction in rod powers with burnup. (auth)

**2099** PRODUCTION APPARATUS FOR NUCLEAR REACTOR FUEL RODS. Lohrbach, W. (to Siemens Aktiengesellschaft). US Patent 3,757,396. 11 Sep 1973. Priority Date 19 Aug 1970, F. R. Germany. 4p.

When machining, filling, and cleansing casing tubes in the production of reactor fuel rods, the latter are disposed in a closed container and held therein in support tubes. Individual processing equipment is located at one face of the container while, at the other face thereof, a rotary shaft provided with grippers, drives for displacing the support tubes into the individual processing position, and drives of clamping devices for the support tubes are provided. Consequently, only parts having a smooth surface and being relatively easy to decontaminate are present in the interior of the container. 5 figures. (Official Gazette)

**2100** IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR FUEL ELEMENTS. Clapham, L. (to United Kingdom Atomic Energy Authority). British Patent 1,324,192. 18 Jul 1973. Filed date 29 Oct 1970. 5p.

Reference is made to fuel element assemblies consisting of a number of spaced fuel pins supported in a bundle with their longitudinal axes parallel. Some problems arising in the use of such fuel element assemblies are stated. Due to vibration of the assemblies in use, unscrewing of the fuel pins from the lower end fitting can occur. Also unscrewing of the retaining nuts on the threaded spigots at the upper ends of the fuel pins. The object of the arrangement described is to provide locking means to avoid these problems. (UK)

## Reactor Control Systems

**2101** (GEAP-13824-5) LMFBR ALTERNATE SHUTDOWN SYSTEM DEVELOPMENT AND TESTING. Fifth Quarterly Report, January-March 1973. (General Electric Co., Sunnyvale, Calif. Breeder Reactor Dept.). Apr 1973. Contract AT(04-3)-893. 54p. AT.

The Alternate Shutdown System (ALSS) reference latch concept that has a collet-type mechanism was selected. A linkage-type latch was selected as a backup to the collet-type mechanism. A hydraulic test rig is being designed for the damper component tests. A solid-state system was selected for the ALSS logic system reference design. (auth)

**2102** SPECTRAL ANALYSIS OF SAMPLED NUCLEAR REACTOR PLANT DATA WITH HETERODYNE DIGITAL FILTERING TECHNIQUES. Roggenbauer, H. (OECD Halden Reactor Project, Halden, Norway); Seifritz, W.; Lindmo, T. Nucl. Technol.; 20: No. 2, 79-85(Nov 1973).

A design procedure for the digital algorithm of a heterodyne power spectral density analyzer using digital components has been developed. The heterodyne filtering, a straightforward technique to yield directly the spectral densities, avoids a number of the disadvantages inherent in the method of determining spectral densities of stochastic signals using the Fourier transform of precalculated correlation functions. For the design of the required digital low-pass filters in this system, the method of bilinear conformal transformation of the continuous s domain onto the discrete z domain has been used to generate recursive filter difference equations. The complete digital analyzer, consisting of a group of digital filters with contiguous passbands, has been implemented on a process computer and tested with real plant data at the OECD Halden Reactor. (6 references) (auth)

## Nuclear Power Plant Economics

**2103** INCREASING ROLE OF NUCLEAR POWER. Hill, J. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Atom (London); No. 203, 194-197(Sep 1973).

The Chairman of the United Kingdom Atomic Energy Authority reviews the history, present position, and probable future role of nuclear power in the U. K. Comparisons are made with the position in other countries. (UK)

## Reactor Licensing and Regulation

**2104** (CONF-700867-, pp 347-349) COINCIDENT INSTRUMENT FAILURE RESULTS IN OVERPOWER OPERATION OF A

TRIGA REACTOR. Clack, R. W.; Ervin, P. F. (Kansas State Univ., Manhattan). 1970.

From European TRIGA owners' conference; Otaniemi, Finland (25 Aug 1970).

Removal of an annular, dry irradiation facility from the reflector region of a TRIGA Mk II reactor caused an unanticipated reduction of ion chamber sensitivity of a factor-of-two. Available reactivity and control rod worth and calibration were essentially unaffected. Loss of sensitivity of power indicating channels combined with malfunction of pulse rod position indicating lights resulted in a brief operation about 60% above licensed power level. (auth)

**2105** (DOCKET-50010-185) DRESDEN NUCLEAR POWER STATION, UNIT 1. Malfunction of Motor Operated Valve CS-17 in the Core Spray System. (Commonwealth Edison Co., Chicago, Ill. (USA)). 14 Aug 1973. 3p. Dep. NTIS $3.00.

During valve operability surveillance of the core spray system, the CS-17 motor operated valve failed to open on signal. The failure was traced to an improperly set limit switch on the CS-16 value which is interlocked with the CS-17 valve. The ability of the core spray system to function as intended was not jeopardized by the failure. (JWR)

**2106** (DOCKET-50010-186) DRESDEN NUCLEAR POWER STATION, UNIT 1. The Fire Protection System Diesel Driven Fire Pump Failed to Start on an Automatic Signal from a Preset Timer. (Commonwealth Edison Co., Chicago, Ill. (USA)). 21 Jun 1973. 2p. Dep. NTIS $3.00.

**2107** (DOCKET-50010-195) DRESDEN NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence: Malfunction of Core Spray Valve M.O.-C.S.16. (Commonwealth Edison Co., Chicago, Ill. (USA)). 18 Sep 1973. 3p. Dep. NTIS $3.00.

**2108** (DOCKET-50016-204) ENRICO FERMI ATOMIC POWER PLANT, UNIT 1. Fire Incident. (Power Reactor Development Co., Detroit, Mich. (USA)). 13 Sep 1973. 3p. Dep NTIS $3.00.

A fire incident occurred during the disposal of 20 gallons of alcohol which had been used for sodium cleanup. The fire was apparently caused by a small piece of metallic sodium which ignited when the alcohol was poured into a trough of flowing water. The fire was extinguished with fire hoses. Equipment damage was estimated to be $5,000. (JWR)

**2109** (DOCKET-50029-274) YANKEE NUCLEAR POWER STATION. Possible Effects of Fuel Densification on Subsequent Operation of Yankee Rowe Cycle X. (Yankee Atomic Electric Co., Westboro, Mass. (USA)). 15 Oct 1973. 60p. Dep. NTIS $5.00.

**2110** (DOCKET-50155-166) BIG ROCK POINT NUCLEAR PLANT. Special Report No. 15, Preliminary Description of Reactor Depressurization System. (Consumers Power Co., Jackson, Mich. (USA)). 24 Jul 1973. 38p. Dep. NTIS $4.00.

**2111** (DOCKET-50155-169) BIG ROCK POINT NUCLEAR PLANT. Special Report No. 14, Big Rock Point Plant Operations. (Consumers Power Co., Jackson, Mich. (USA)). 5 Jul 1973. 25p. Dep. NTIS $3.25.

**2112** (DOCKET-50206-232) SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1. Supporting Information on Periodic Axial Offset Monitoring. (Southern California Edison Co., Rosemead, Calif. (USA)). 10 Sep 1973. 13p. Dep. NTIS $3.00.

The results of analyses and measurements conducted to establish periodic axial offset monitoring are presented. The monitoring is intended to insure that the core peaking factors remain below the limits established in the fuel densification safety analysis. (JWR)

**2113** (DOCKET-50206-237) SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1. Final Environmental Statement. (Southern California Edison Co., Rosemead, Calif. (USA)). Oct 1973. 330p. Dep. NTIS $18.50.

The environmental effects of construction and operation of the San Onofre Nuclear Generating Station, Unit 1 are examined. The descriptions include: the environment in the area, including the history, geography, geology, hydrology, climatology, ecology, land and water use including chemical characteristics; the facility and its effluents; the impacts from construction and operation of the facility; alternatives to the proposed action; irreversible and irretrievable long-term commitments of resources from plant operation; need for power; and the benefits-cost analysis of the proposed plant operation. (FS)

**2114** (DOCKET-50213-232) HADDAM NECK PLANT. Abnormal Occurrence: Malfunction of the Low Pressure Letdown System Thereby Venting Letdown Fluid to the Volume Control Tank. (Office of Radiation Programs, Washington, D. C. (USA). Field Operations Div.). 22 Jun 1973. 1p. Dep. NTIS $3.00.

**2115** (DOCKET-50213-236) HADDAM NECK PLANT. Abnormal Occurrence No. 73-8: Failure of Steam Generator Seismic Support Hold-Down Bolts. (Connecticut Yankee Atomic Power Co., East Hampton, Conn. (USA)). 28 Sep 1973. 2p. Dep. NTIS $3.00.

**2116** (DOCKET-50213-238) HADDAM NECK PLANT. Nuclear and Thermal Hydraulic Analysis for Core V. (Connecticut Yankee Atomic Power Co., Hartford (USA)). 11 Oct 1973. 9p. Dep. NTIS $3.00.

**2117** (DOCKET-50213-240) HADDAM NECK PLANT. Abnormal Occurrence Report No. AO-73-9: Unsatisfactory Test of Timers Associated with the Emergency Diesel Generator/Core Cooling System. (Connecticut Yankee Atomic Power Co., East Hampton, Conn. (USA)). 18 Oct 1973. 2p. Dep. NTIS $3.00.

**2118** (DOCKET-50219-301) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Abnormal Occurrence: Variance in Closing Time of a Main Steam Isolation Valve NS04B. (Jersey Central Power and Light Co., Morristown, N. J. (USA)). 3 Aug 1973. 2p. Dep. NTIS $3.00.

**2119** (DOCKET-50219-310) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Abnormal Occurrence Report 73-15: Closure of Main Steam Isolation Valve NS04B in less than Three Seconds. (Jersey Central Power and Light Co., Morristown, N. J. (USA)). 25 Jul 1973. 3p. Dep. NTIS $3.00.

During full closure timing and scram checks prior to a plant startup, one of four Main Steam Isolation Valves closed in less time than the Technical Specification limit. The hydraulic dashpot was found to contain insufficient oil. An oil leak was detected which was corrected by replacing the seal cartridge assembly. Oil was then added and the valve operated properly. (JWR)

**2120** (DOCKET-50219-317) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Abnormal Occurrences: Status of Follow-Up Efforts. (Jersey Central Power and Light Co., Morristown, N. J. (USA)). 30 Aug 1973. 8p. Dep. NTIS $3.00.

**2121** (DOCKET-50219-318) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Chronology of Fish Mortalities Events, August 9, 1973. (Jersey Central Power and Light Co., Morristown, N. J. (USA)). 31 Aug 1973. 3p. Dep. NTIS $3.00.

**2122** (DOCKET-50219-319) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Abnormal Occurrence Report No. 73-19: Although Both Startup Transformers Were Energized to Carry Power to the Station 4160V ac Buses, Neither Transformer Was Operable Due to an Improper Setting on the C Base Differential Monitoring Relay. (Jersey Central Power and Light Co., Morristown, N. J. (USA)). 10 Sep 1973. 4p. Dep. NTIS $3.00.

**2123** (DOCKET-50219-320) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Abnormal Occurrence Report No. 73-20: Failure of Isolation Condenser NE01A Condensate Return Valve V-14-34 to Operate During the Last Stages of a Plant Cooldown. (Jersey Central Power and Light Co., Morristown, N. J. (USA)). 10 Sep 1973. 3p. Dep. NTIS $3.00.

**2124** (DOCKET-50219-321) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Abnormal Occurrence Report No. 73-21: Failure of 21 Hydraulic Shock and Sway Arrestors on Piping Systems in the Drywell, Including Units on Both Core Spray and Both Isolation Condenser Loops. (Jersey Central Power and Light Co., Morristown, N. J. (USA)). 10 Sep 1973. 3p. Dep. NTIS $3.00.

**2125** (DOCKET-50219-322) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Abnormal Occurrence Report No. 73-22: Excessive Leakage Through Main Steam Isolation Valve NS03B. (Jersey Central Power and Light Co., Morristown, N. J. (USA)). 10 Sep 1973. 3p. Dep. NTIS $3.00.

**2126** (DOCKET-50219-327) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Abnormal Occurrence: Failure of the Main Steam Isolation Valve NSO3B. (Jersey Central Power and Light Co., Morristown, N. J. (USA)). 21 Sep 1973. 3p. Dep. NTIS $3.00.

**2127** (DOCKET-50219-329) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Status of Main Steam Isolation Valve Evaluation. (Jersey Central Power and Light Co., Morristown, N. J. (USA)). 1 Oct 1973. 2p. Dep. NTIS $3.00.

**2128** (DOCKET-50219-330) OYSTER CREEK NUCLEAR POWER PLANT. UNIT 1. Abnormal Occurrence: Failure of Differential Pressure Switch DPS66A. (Jersey Central Power and Light Co., Morristown, N. J. (USA)). 3 Oct 1973. 3p. Dep. NTIS $3.00.

**2129** (DOCKET-50219-331) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Preliminary Abnormal Occurrence Report No. AO-73-24: Failure of Main Steam Isolation Valves NSO4A and NSO4B to Meet Acceptable Leakage. (Jersey Central Power and Light Co., Morristown, N. J. (USA)). 28 Sep 1973. 3p. Dep. NTIS $3.00.

**2130** (DOCKET-50219-332) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Preliminary Abnormal Occurrence Report No. AO-73-25: Failure of Isolation Condenser Initiation Relay 6K12 to Function when Deenergized. (Jersey Central Power and Light Co., Morristown, N. J. (USA)). 1 Oct 1973. 3p. Dep. NTIS $3.00.

**2131** (DOCKET-50219-333) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Information re the Drywell Vacuum Breaker Valves. (Jersey Central Power and Light Co., Morristown, N. J. (USA)). 8 Oct 1973. 5p. Dep. NTIS $3.00.

**2132** (DOCKET-50219-334) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Abnormal Occurrence: Isolation Condenser Relay Failure. (Jersey Central Power and Light Co., Morristown, N. J. (USA)). 9 Oct 1973. 2p. Dep. NTIS $3.00.

**2133** (DOCKET-50219-335) OYSTER CREEK NUCLEAR POWER PLANT, UNIT 1. Abnormal Occurrence: Failure of Main Steam Isolation Valves (NS04A and NS04B). (Jersey Central Power and Light Co., Morristown, N. J. (USA)). 12 Oct 1973. 2p. Dep. NTIS $3.00.

**2134** (DOCKET-50220-169) NINE MILE POINT NUCLEAR STATION, UNIT 1. Abnormal Occurrence: Four Fuel Bundle Segments Were Found to Be Operating Slightly in Excess of the Allowable Average Planar LHGR. (Niagara Mohawk Power Corp., Syracuse, N. Y. (USA)). 7 Sep 1973. 2p. Dep. NTIS $3.00.

**2135** (DOCKET-50220-179) NINE MILE POINT NUCLEAR STATION, UNIT 1. Semiannual Operating Report, January–June 1973, Addendum 1. (Niagara Mohawk Power Corp., Syracuse, N. Y. (USA)). 14 Sep 1973. 6p. Dep. NTIS $3.00.

**2136** (DOCKET-50220-181) NINE MILE POINT NUCLEAR STATION, UNIT 1. Safety Analysis for Type 5 and 6 Reload Fuel. (Niagara Mohawk Power Corp., Syracuse, N. Y. (USA)). 15 Oct 1973. 46p. Dep. NTIS $4.50.

**2137** (DOCKET-50231-137) SOUTHWEST EXPERIMENTAL FAST OXIDE REACTOR. Quarterly Environmental and Facility Radiation Survey, June 1–August 31, 1973. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). 14 Sep 1973. 4p. Dep. NTIS $3.00.

**2138** (DOCKET-50237-382) DRESDEN NUCLEAR POWER STATION, UNIT 2. Handling of the IF-300 Spent Fuel Shipping Cask, Addendum 1. (Commonwealth Edison Co., Chicago, Ill. (USA)). 2 Jul 1973. 6p. Dep NTIS $3.00.

Analyses on the effects of cask drop on the fuel pool walls are presented. (JWR)

**2139** (DOCKET-50237-383) DRESDEN NUCLEAR POWER STATION, UNIT 2. Abnormal Occurrence: Blockage of the 2-1530-184 AS Relay. (Commonwealth Edison Co., Chicago, Ill. (USA)). 16 Jul 1973. 2p. Dep. NTIS $3.00.

The blockage of the 2-1530-184 AS relay in the LPCI logic circuit due to an incorrectly installed cover plate is reported. Due to redundancy in the system the LPCI system would have operated properly in the case of a line break. (JWR)

**2140** (DOCKET-50237-384) DRESDEN NUCLEAR POWER STATION, UNIT 2. Final Control Rod Drive Anomaly Report. (Commonwealth Edison Co., Chicago, Ill. (USA)). 17 Jul 1973. 6p. Dep. NTIS $3.00.

**2141** (DOCKET-50237-386) DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3. Special Report No. 23A: Supplemental Information Concerning Drywell to Torus Vacuum Breakers. (Commonwealth Edison Co., Chicago, Ill. (USA)). 1 Aug 1973. 14p. (DOCKET-50249-281). Dep. NTIS $3.00.

**2142** (DOCKET-50237-390) DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3. Special Report No. 18, Supplement B. (Commonwealth Edison Co., Chicago, Ill. (USA)). 25 Sep 1973. 8p. (DOCKET-50249-285). Dep. NTIS $3.00.

**2143** (DOCKET-50237-394) DRESDEN NUCLEAR POWER STATION, UNIT 2. Malfunction of LPCI Valve 2-1501-3A. (Commonwealth Edison Co., Chicago, Ill. (USA)). 14 Sep 1973. 2p. Dep. NTIS $3.00.

During an attempt to open LPCI valve 2-1501-3A, the supply breaker for the valve tripped. The problem was traced to an incorrect setting of the magnetic trip breaker for the valve. In the case of a loss of coolant accident the valve could have been opened manually. In addition, the redundancy in the system would have insured the operability of the system. (JWR)

**2144** (DOCKET-50237-395) DRESDEN NUCLEAR POWER STATION, UNIT 2. Failure of LPCI Valve 2-1501-20B. (Commonwealth Edison Co., Chicago, Ill. (USA)). 18 Sep 1973. 2p. Dep. NTIS $3.00.

**2145** (DOCKET-50237-396) DRESDEN NUCLEAR POWER STATION, UNIT 2. Abnormal Occurrence: Failure of Low Pressure Coolant Injection Valves MO-2-1501-19A and MO-2-1501-19B. (Commonwealth Edison Co., Chicago, Ill. (USA)). 19 Sep 1973. 3p. Dep. NTIS $3.00.

**2146** (DOCKET-50237-397) DRESDEN NUCLEAR POWER STATION, UNIT 2. Abnormal Occurrence: Failure of Main Steam Line Drain Isolation Valve MO-2-220-2 to Operate. (Commonwealth Edison Co., Chicago, Ill. (USA)). 21 Sep 1973. 2p. Dep. NTIS $3.00.

**2147** (DOCKET-50237-398) DRESDEN NUCLEAR POWER STATION, UNIT 2. Abnormal Occurrence: Failure of LPCI Valve 2-1501-3A to Open. (Commonwealth Edison Co., Chicago, Ill. (USA)). 21 Sep 1973. 2p. Dep. NTIS $3.00.

During surveillance prior to removing a service water pump from service for repacking the 2-1501-3A LPCI valve failed to open on signal. It was discovered that the slide wire on the feedback potentiometer had shifted which caused the control circuitry to malfunction. The closure of the valve would not have affected the capability of the LPCI system to inject in the case of an accident. (JWR)

**2148** (DOCKET-50244-199) ROBERT EMMETT GINNA NUCLEAR POWER PLANT, UNIT 1. Abnormal Occurrence No. 73-8: Failure of the 1A Steam Generator Steam Flow Channel. (Rochester Gas and Electric Corp., N. Y. (USA)). 14 Sep 1973. 2p. Dep. NTIS $3.00.

**2149** (DOCKET-50244-208) ROBERT EMMETT GINNA NUCLEAR POWER PLANT, UNIT 1. Fuel Densification Effects, Low Pressure Analysis. (Rochester Gas and Electric Corp., N. Y. (USA)). Jul 1973. 38p. (WCAP-8153). Dep. NTIS $4.00.

The consequences of operation with reduced system pressure on plant power capability and on reactor safety are analyzed in conjunction with fuel densification effects. (JWR)

**2150** (DOCKET-50245-257) MILLSTONE NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence Report, AO-73-7: Potential Problem With the Installed Control Blades. (Millstone Point Co., Hartford, Conn. (USA)). 18 Jul 1973. 1p. Dep. NTIS $3.00.

**2151** (DOCKET-50245-285) MILLSTONE NUCLEAR POWER STATION, UNIT 1. Correspondence Re Shock Arrestor Failures. (Millstone Point Co., Hartford, Conn. (USA)). 18 Jul 1973. 2p. Dep. NTIS $3.00.

**2152** (DOCKET-50245–287) MILLSTONE NUCLEAR POWER STATION; UNIT 1. Unusual Event: Malfunction of "B" Level Switch. (Millstone Point Co., Hartford, Conn. (USA)). 4 Oct 1973. 1p. Dep. NTIS $3.00.

**2153** (DOCKET-50245-299) MILLSTONE NUCLEAR POWER STATION, UNIT 1. Unusual Event: A Leak Was Discovered in the One-Inch Stainless Steel Containment Penetration Piping of the Feedwater Sparger $\Delta p$ Sensing Line. (Millstone Point Co., Hartford, Conn. (USA)). 6 Aug 1973. 2p. Dep. NTIS $3.00.

**2154** (DOCKET-50247-141) INDIAN POINT STATION, UNIT 2. Abnormal Occurrence: During Maintenance of the Closure Mechanism of the 80′ Elevation Outer Door of the Vapor Container, the Inner Door was Partially Opened for a Short Period. (Consolidated Edison Co. of New York, Inc., New York (USA)). 27 Sep 1973. 2p. Dep. NTIS $3.00.

**2155** (DOCKET-50249-302) DRESDEN NUCLEAR POWER STATION, UNIT 3. Abnormal Occurrence: LPCI Test Valve MO3-1501-20B Failure. (Commonwealth Edison Co., Chicago, Ill. (USA)). 18 Oct 1973. 3p.. Dep. NTIS $3.00.

**2156** (DOCKET-50249-303) DRESDEN NUCLEAR POWER STATION, UNIT 3. Abnormal Occurrence: Malfunction of MO-3-1301-1 Valve in the Isolation Condenser System. (Commonwealth

Edison Co., Chicago, Ill. (USA)). 18 Oct 1973. 2p. Dep. NTIS $3.00.

**2157** (DOCKET-50250-154) TURKEY POINT PLANT, UNIT 3. Abnormal Occurrence Report No. 3-73-9: Failure of No. A Emergency Diesel-Generator to Start. (Florida Power and Light Co). 14 Sep 1973. 5p. Dep. NTIS $3.00.

The No. A emergency diesel-generator failed to start during a functional test on Sept. 5, 1973. The lockout relay had actuated due to the failure of the engine to reach minimum speed within the time required for a confirmed start. The cause of the failure has not been determined. The operability of the engine was subsequently demonstrated by four consecutive successful starts. (JWR)

**2158** (DOCKET-50250-161) TURKEY POINT PLANT, UNITS 3 AND 4. Semiannual Environmental Monitoring Report, April 19–June 30, 1973. (Florida Power and Light Co. (USA)). 28 Sep 1973. 76p. (DOCKET-50251-148). Dep. NTIS $6.00.

**2159** (DOCKET-50251-155) TURKEY POINT PLANT, UNIT 4. Abnormal Occurrence Report No. 4-73-11: Intrusion of Dilute Water Into the Concentrated Boric Acid System. (Florida Power and Light Co. (USA)). 1 Oct 1973. 3p. Dep. NTIS $3.00.

**2160** (DOCKET-50251-161) TURKEY POINT PLANT, UNIT 4. Abnormal Occurrence Report No. 4-73-12: About 50 to 75 Gallons of Reactor Coolant Was Released to the Charging Pump Room in the Auxiliary Building via a Failed Bellows in Relief Valve 4-209. (Florida Power and Light Co. (USA)). 16 Oct 1973. 3p. Dep. NTIS $3.00.

**2161** (DOCKET-50254-219) QUAD-CITIES STATION, UNIT 1. Abnormal Occurrence: Suppression Chamber Water Level Exceeded Specifications. (Commonwealth Edison Co., Cordova, Ill. (USA)). 20 Aug 1973. 2p. Dep. NTIS $3.00.

**2162** (DOCKET-50254-248) QUAD-CITIES STATION, UNITS 1 AND 2. Abnormal Occurrence: Count of the Reactor Building Ventilation Stack Sample Filters and Cartridges Indicated Excessive Release of $^{131}$I and Particulates with Half Lives Longer than 8 Days. (Commonwealth Edison Co., Cordova, Ill. (USA)). 20 Jun 1973. 3p. (DOCKET-50265-241). Dep. NTIS $3.00.

**2163** (DOCKET-50254-251) QUAD-CITIES STATION, UNITS 1 AND 2. Abnormal Occurrence: the Shared Diesel Generator Was Inoperable Due to Loss of Control Power. (Commonwealth Edison Co., Cordova, Ill. (USA)). 9 Jul 1973. 3p. (DOCKET-50265-244). Dep. NTIS $3.00.

**2164** (DOCKET-50254-253) QUAD-CITIES STATION, UNITS 1 AND 2. Abnormal Occurrence: Unit 2 Standby Liquid Control System "A" Was Inoperable Due to Premature Lifting of the Pump Relief Valve. (Commonwealth Edison Co., Cordova, Ill. (USA)). 11 Jul 1973. 3p. (DOCKET-50265-245). Dep. NTIS $3.00.

**2165** (DOCKET-50254-254) QUAD-CITIES STATION, UNITS 1 AND 2. Abnormal Occurrence: Reactor Building Ventilation Stack Sample Cartridge Indicated an Excessive Release Rate for $^{131}$I and Particulates with Half-Lives Greater than 8 Days. (Commonwealth Edison Co., Cordova, Ill. (USA)). 20 Jul 1973. 4p. (DOCKET-50265-246). Dep. NTIS $3.00.

**2166** (DOCKET-50254-258) QUAD-CITIES STATION, UNITS 1 AND 2. Semiannual Nonradiological Environmental Report and Appendices, February–July 1973. (Commonwealth Edison Co., Chicago, Ill. (USA)). 9 Oct 1973. 1465p. (DOCKET-50265-250). Dep. NTIS $55.58.

Results of the environmental monitoring program during the operation of the Station's diffuser discharge pipe system are presented. The diffuser pipe mode of discharge was operated for one year. Biological and limnological monitoring shows that there were no detectable effects on any biotic or abiotic component in the river. (FS)

**2167** (DOCKET-50254-262) QUAD-CITIES STATION, UNITS 1 AND 2. Abnormal Occurence: The Reactor Was Not in the Cold Shutdown Condition Because the Mode Switch Was in the Refuel Position. (Commonwealth Edison Co., Cordova, Ill. (USA)). 20 Sep 1973. 2p. Dep. NTIS $3.00.

**2168** (DOCKET-50254-263) QUAD-CITIES STATION, UNITS 1 AND 2. Abnormal Occurrence: Excessive Release of $^{131}$I and Particulates with Half Lives Longer Than 8 Days From the Reactor Building Ventilation Stack. (Commonwealth Edison Co., Cordova, Ill. (USA)). 21 Sep 1973. 3p. (DOCKET-50265-259). Dep. NTIS $3.00.

**2169** (DOCKET-50254-264) QUAD-CITIES STATION, UNITS 1 AND 2. Special Report 2B, Jet Pump Forcing Functions. (Commonwealth Edison Co., Chicago, Ill. (USA)). 21 Sep 1973. 6p. (DOCKET-50265-253). Dep. NTIS $3.00.

**2170** (DOCKET-50254-268) QUAD-CITIES STATION, UNITS 1 AND 2. Abnormal Occurrence: Excessive Release of Iodine and Particulates from the Reactor Building Vent Stack. (Commonwealth Edison Co., Cordova, Ill. (USA)). 3 Oct 1973. 4p. (DOCKET-50265-258). Dep. NTIS $3.00.

**2171** (DOCKET-50254-271) QUAD-CITIES STATION, UNITS 1 AND 2. Request for Review of Reactor Building Stack Effluent Limits. (Commonwealth Edison Co., Chicago, Ill. (USA)). 5 Oct 1973. 6p. (DOCKET-50265-257). Dep. NTIS $3.00.

**2172** (DOCKET-50254-273) QUAD-CITIES STATION, UNITS 1 AND 2. Hypochlorination Test Program. (Commonwealth Edison Co., Chicago, Ill. (USA)). 25 Sep 1973. 33p. (DOCKET-50265-261). Dep. NTIS $3.75.

Results of preliminary measurements are presented in a program to determine a technique for successful condenser chlorination with an acceptable effluent to be returned to the Mississippi River. (FS)

**2173** (DOCKET-50254-278) QUAD-CITIES STATION, UNIT 1. Abnormal Occurrence: Malfunction of a BWR Off Gas Filter. (Commonwealth Edison Co., Cordova, Ill. (USA)). 20 Oct 1973. 3p. Dep. NTIS $3.00.

**2174** (DOCKET-50255-173) PALISADES NUCLEAR PLANT. Correspondence on Two Abnormal Occurrences Involving Control Rod and Control Valve Problems. (Consumers Power Co., Jackson, Mich. (USA)). 20 Aug 1973. 3p. Dep. NTIS $4.00.

**2175** (DOCKET-50255-191) PALISADES NUCLEAR PLANT. Abnormal Occurrence Report No. AO-3-73: Computer Power Level was 10% Below that Established by the Plant Heat Balance. (Consumers Power Co., Jackson, Mich. (USA)). 17 Jul 1973. 3p. Dep. NTIS $3.00.

**2176** (DOCKET-50255-192) PALISADES NUCLEAR PLANT. Abnormal Occurrence Report No. AO-5-73: Component Cooling Water Pump Coupling Failure. Abnormal Occurrence Report No. AO-6-73: Diesel Generator Low Frequency Operation. Abnormal Occurrence Report No. AO-7-73: Thermal Margin/Low-Pressure Trip Set Point Variation. (Consumers Power Co., Jackson, Mich. (USA)). 13 Aug 1973. 2p. Dep. NTIS $3.00.

**2177** (DOCKET-50255-194) PALISADES NUCLEAR PLANT. Abnormal Occurrence Report No. AO-4-73: Insertion of One Control Rod Slightly Beyond the Power Dependent Insertion Limit. (Consumers Power Co., Jackson, Mich. (USA)). 2 Aug 1973. 2p. Dep. NTIS $3.00.

**2178** (DOCKET-50255-195) PALISADES NUCLEAR PLANT. Monthly Primary and Secondary Radioactivity and Effluent Report, June 1973. (Consumers Power Co., Jackson, Mich. (USA)). 25 Jul 1973. 3p. Dep. NTIS $3.00.

**2179** (DOCKET-50255-203) PALISADES NUCLEAR PLANT. Report of an Increase in the Primary to Secondary Leakage in the "B" Steam Generator. (Consumers Power Co., Jackson, Mich. (USA)). 8 Aug 1973. 2p. Dep. NTIS $3.00.

**2180** (DOCKET-50259-133) BROWNS FERRY NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence Report BFAO 731W: Failure of a Refueling Interlock. (Tennessee Valley Authority, Chattanooga (USA)). 6 Jul 1973. 2p. Dep. NTIS $3.00.

**2181** (DOCKET-50259-134) BROWNS FERRY NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence Report BFAO-732W: Discovery of Disconnected High-Voltage Cables in 7 of the 8 IRM Channel Drawers During Initial Fuel Loading. (Tennessee Valley Authority, Chattanooga (USA)). 9 Jul 1973. 2p. Dep. NTIS $3.00.

**2182** (DOCKET-50259-138) BROWNS FERRY NUCLEAR POWER STATION, UNIT 1. Failure of Drywell Penetration EF, Connector 9E. (Tennessee Valley Authority, Chattanooga (USA)). 11 Jul 1973. 3p. Dep. NTIS $3.00.

**2183** (DOCKET-50259-139) BROWNS FERRY NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence Report BFAO-733W: Malfunction of a Refueling Bridge Interlock Switch. (Tennessee Valley Authority, Chattanooga (USA)). 13 Jul 1973. 2p. Dep. NTIS $3.00.

**2184** (DOCKET-50259-140) BROWNS FERRY NUCLEAR POWER STATION, UNIT 1. Sequoyah Nuclear Plant, Unit 1. Correspondence re Failure of Limitorque Operators of Suppression Pool Spray Valves FCV-1-74-72 and FCV-1-74-58 and Deficiency in the RCIC Turbine (DDN-143) EGM Speed Control and Governor at Browns Ferry and Cracks in the Jacket-Water Temperature Regulating Valves in the Emergency Diesel Generator Engines at Sequoyah. (Tennessee Valley Authority, Chattanooga (USA)). 17 Jul 1973. 4p. (DOCKET-50327-47). Dep. NTIS $3.00.

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2188 (DOCKET-50259-154) BROWNS FERRY NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence Reports BF EAO-732W, -733W, -734W, and -735W: Correspondence Re Fish Kill Estimates. (Tennessee Valley Authority, Chattanooga (USA)). 17 Aug 1973. 3p. Dep. NTIS $3.00.

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2190 (DOCKET-50259-156) BROWNS FERRY NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence Report BFAO 7312W: Failure of Reactor Building to Suppression Chamber Vacuum Breakers to Operate. (Tennessee Valley Authority, Chattanooga (USA)). 21 Sep 1973. 2p. Dep. NTIS $3.00.

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2192 (DOCKET-50259-158) BROWNS FERRY NUCLEAR POWER STATION, UNIT 1. Environmental Abnormal Occurrence Reports BF EAO-7312W, -7313W, - 7314W, -7315W, and 7316W: Fish Impingement Estimates. (Tennessee Valley Authority, Chattanooga (USA)). 17 Sep 1973. 3p. Dep. NTIS $3.00.

2193 (DOCKET-50259-162) BROWNS FERRY NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence Report BFAO 7310W: Malfunction of Three Differential Pressure Switches in LPCI Logic System. (Tennessee Valley Authority, Chattanooga (USA)). 18 Sep 1973. 2p. Dep. NTIS $3.00.

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2198 (DOCKET-50259-171) BROWNS FERRY NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence Report BFAO 7316W: Failure of the Stack Gas Monitor. (Tennessee Valley Authority, Chattanooga (USA)). 5 Oct 1973. 2p. Dep. NTIS $3.00.

2199 (DOCKET-50259-174) BROWNS FERRY NUCLEAR POWER STATION, UNIT 1. Environmental Abnormal Occurrence Report BF EAO-7317W and -7318W: Fish Impingements on Intake Screens. (Tennessee Valley Authority, Chattanooga (USA)). 2 Oct 1973. 3p. Dep. NTIS $3.00.

2200 (DOCKET-50259-175) BROWNS FERRY NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence Report BFAO 7313W: Malfunction of a Differential Pressure Switch in RCIC Isolation Logic. (Tennessee Valley Authority, Chattanooga (USA)). 24 Sep 1973. 2p. Dep. NTIS $3.00.

2201 (DOCKET-50259-176) BROWNS FERRY NUCLEAR POWER STATION, UNIT 1. Mailgrams re Fish Impingement. Abnormal Occurrence Report BFEAO-7319W Through 7324W: Fish Impingements which Occurred while Washing the Circulating Water Pump Traveling Screens at the Pumping Station. Mailgram re Improper Operation of the HPCI. (Tennessee Valley Authority, Chattanooga (USA)). 11 Oct 1973. 6p. Dep. NTIS $3.00.

2202 (DOCKET-50259-179) BROWNS FERRY NUCLEAR POWER STATION, UNITS 1, 2, AND 3. Design Deficiency Report on Target Rock Safety-Relief Valves. (Tennessee Valley Authority, Chattanooga (USA)). 10 Sep 1973. 7p. (DOCKET-50260-114; DOCKET-50296-104). Dep. NTIS $3.00.

2203 (DOCKET-50259-180) BROWNS FERRY NUCLEAR POWER STATION, UNITS 1, 2, AND 3. Semiannual Report on Environmental Radioactivity Levels, July—December 1972. (Tennessee Valley Authority, Chattanooga (USA)). 3 Oct 1973. 33p. (DOCKET-50260-115; DOCKET-50296-105). Dep. NTIS $3.75.

The environmental monitoring program to establish a baseline of data on the distribution of natural and manmade radioactivity in the environment near the plant site is presented. Information concerning atmospheric, terrestrial, and reservoir monitoring is included. (FS)

2204 (DOCKET-50259-182) BROWNS FERRY NUCLEAR POWER STATION, UNITS 1, 2, AND 3. Semiannual Report on Environmental Radioactivity Levels, January—June 1972. (Tennessee Valley Authority, Chattanooga (USA)). 20 Sep 1973. 33p. (DOCKET-50260-117; DOCKET-50296-107). Dep. NTIS $3.75.

2205 (DOCKET-50259-191) BROWNS FERRY NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence Report BFAO-7321W: Malfunction of Drywell Pressure Switches PS-64-56B and C. (Tennessee Valley Authority, Chattanooga (USA)). 17 Oct 1973. 2p. Dep. NTIS $3.00.

2206 (DOCKET-50259-207) BROWNS FERRY NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence Report No. BFAO-7328W: Malfunction of Level Switches. (Tennessee Valley Authority, Chattanooga (USA)). 26 Oct 1973. 2p. Dep. NTIS $3.00.

2207 (DOCKET-50259-208) BROWNS FERRY NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence Report BFAO-7326W: Malfunction of Three Differential Pressure Switches in the LPCI Logic System. (Tennessee Valley Authority, Chattanooga (USA)). 25 Oct 1973. 2p. Dep. NTIS $3.00.

2208 (DOCKET-50259-209) BROWNS FERRY NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence Report No. BFAO-7324W: Failure of the Stack Gas Monitoring System. (Tennessee Valley Authority, Chattanooga (USA)). 25 Oct 1973. 2p. Dep. NTIS $3.00.

2209 (DOCKET-50260-122) BROWNS FERRY NUCLEAR POWER STATION, UNITS 2 AND 3. Final Report on Inverted Absorber Tubes in Control Rods. (Tennessee Valley Authority, Chattanooga (USA)). 29 Oct 1973. 4p. (DOCKET-50296-110). Dep. NTIS $3.00.

2210 (DOCKET-50261-251) H. B. ROBINSON PLANT, UNIT 2. Irradiation Surveillance Program. (Carolina Power and Light Co., Raleigh, N. C. (USA)). 19 Sep 1973. 10p. Dep. NTIS $3.00.

2211 (DOCKET-50261-255) H. B. ROBINSON PLANT, UNIT 2. Semiannual Environmental Monitoring Report, January 1—June 30, 1973. (Carolina Power and Light Co., Raleigh, N.C. (USA)). 27 Sep 1973. 53p. Dep. NTIS $4.75.

The period January 1, 1973 through June 30, 1973 is covered and includes an increase in samples collected, the collection frequency, and also an increase in the scope of detailed analyses. Direct radiation exposure to the general population from noble gases and any other sources was measured by Thermoluminescent Dosimetry (TLD) Area Monitors. Air samples were analyzed to quantitate concentrations of airborne particulate and Iodine-131 which could contribute to inhalation dose and to subsequent land and water use paths following deposition. Many water samples were collected from Lake Robinson to quantitate concentrations in relation to dose to man from Lake use. Ground water samples were analyzed to demonstrate any intrusion to the aquifer from Lake Robinson. Any dose due to interaction with Lake Robinson was also quantitated by analysis of bottom sediments, fish, benthic organisms and aquatic vegetation. Soil samples were collected to show any deposition from reactor effluent. (auth)

**2212** (DOCKET-50261-269) H. B. ROBINSON PLANT, UNIT 2. Monthly Report of Primary and Secondary Activity Measurements and Effluent Discharge Activity Levels, September 1973. (Carolina Power and Light Co., Raleigh, N. C. (USA)). 12 Oct 1973. 2p. Dep. NTIS $3.00.

**2213** (DOCKET-50261-270) H. B. ROBINSON PLANT, UNIT 2. Data for Liquid Waste Samples Collected on June 12, 1973. (Carolina Power and Light Co., Raleigh, N. C. (USA)). 1 Nov 1973. 5p. Dep. NTIS $3.00.

**2214** (DOCKET-50263-259) MONTICELLO NUCLEAR GENERATING PLANT, UNIT 1. Abnormal Occurrence: Malfunction of the B SBGT System Heater. (Northern States Power Co., Minneapolis, Minn. (USA)). 8 Oct 1973. 1p. Dep. NTIS $3.00.

**2215** (DOCKET-50265-249) QUAD-CITIES STATION, UNIT 2. Shared Diesel Generator Turbocharger Failure. (Commonwealth Edison Co., Cordova, Ill. (USA)). 3 Jul 1973. 1p. Dep. NTIS $3.00.

**2216** (DOCKET-50265-266) QUAD-CITIES STATION, UNIT 2. Abnormal Occurrence: A Rod Withdrawal Error Resulted in an Average Planar Linear Heat Generation Rate in Excess of Specifications. (Commonwealth Edison Co., Cordova, Ill. (USA)). 1 Oct 1973. 4p. Dep. NTIS $3.00.

**2217** (DOCKET-50267-78) FORT ST. VRAIN NUCLEAR GENERATING STATION. Summary Report for Environmental Radiation Surveillance, January—June 1973. (Public Service Co. of Colorado, Denver (USA)). 10 Oct 1973. 73p. Dep. NTIS $5.75.

**2218** (DOCKET-50267-79) FORT ST. VRAIN NUCLEAR GENERATION STATION. Deficiency Report re Diffuser Valve Spring Failures. (Public Service Co. of Colorado, Denver (USA)). 11 Oct 1973. 9p. Dep. NTIS $3.00.

**2219** (DOCKET-50267-81) FORT ST. VRAIN NUCLEAR GENERATING STATION. Helium Circulators and Auxiliaries, Final Report. (Public Service Co. of Colorado, Denver (USA)). 1 Nov 1973. 14p. Dep. NTIS $3.00.

**2220** (DOCKET-50267-82) FORT ST. VRAIN NUCLEAR GENERATING STATION. PCRV Cooling Water System, Final Report. (Public Service Co. of Colorado, Denver (USA)). 1 Nov 1973. 13p. Dep. NTIS $3.00.

**2221** (DOCKET-50269-159) OCONEE NUCLEAR STATION, UNIT 1. Unusual Event Report No. UE-73-8: Variance in Main Steam Relief Valve Operation. (Duke Power Co., Charlotte, N. C. (USA)). 25 Oct 1973. 3p. Dep. NTIS $3.00.

**2222** (DOCKET-50269-162) OCONEE NUCLEAR STATION, UNIT 1. Unusual Event Report No. UE-73-9, Malfunction of Borated Water Storage Tank Outlet Valve LP-22. (Duke Power Co., Charlotte, N. C. (USA)). 31 Oct 1973. 3p. Dep. NTIS $3.00.

**2223** (DOCKET-50270-117) OCONEE NUCLEAR STATION, UNIT 2. Structural Integrity Test Report of the Reactor Containment Building. (Duke Power Co., Charlotte, N. C. (USA)). 20 Sep 1973. 62p. Dep. NTIS $5.25.

**2224** (DOCKET-50271-207) VERMONT YANKEE NUCLEAR POWER STATION. Abnormal Occurrence Report AO-73-22: Failure to Perform Source Calibration of the Radiation Monitors Associated with the Reactor Building Vent Exhaust Duct and the Refuelling Zone. (Vermont Yankee Nuclear Power Corp., Rutland (USA)). 31 Jul 1973. 2p. Dep. NTIS $3.00.

**2225** (DOCKET-50271-208) VERMONT YANKEE NUCLEAR POWER STATION. Abnormal Occurrence Report AO-73-23: Failure of a Gamma Radiation Monitor. (Vermont Yankee Nuclear Power Corp., Rutland (USA)). 3 Aug 1973. 1p. Dep. NTIS $3.00.

**2226** (DOCKET-50271-227) VERMONT YANKEE NUCLEAR POWER STATION. Abnormal Occurrence Report No. AO-73-25: Plant Stack Gas Monitoring Systems and the Area Gamma Radiation Monitor on the Perimeter Fence Became Inoperable Following a Direct Lightning Strike to the Top of the Plant Ventilation Stack. (Vermont Yankee Nuclear Power Corp., Rutland (USA)). 31 Aug 1973. 2p. Dep. NTIS $3.00.

**2227** (DOCKET-50271-228) VERMONT YANKEE NUCLEAR POWER STATION. Abnormal Occurrence: An Apparent Detonation in the Off-Gas System Caused Sufficient Back Pressure to Fracture the Air Ejector Rupture Disc, Thereby Degrading a Boundary Designed to Contain Radioactive Material. (Vermont Yankee Nuclear Power Corp., Rutland (USA)). 4 Sep 1973. 2p. Dep. NTIS $3.00.

**2228** (DOCKET-50271-230) VERMONT YANKEE NUCLEAR POWER STATION. Abnormal Occurrence Report No. AO-73-28: Malfunction of a Microswitch Installed in DPIS 2-129B. (Vermont Yankee Nuclear Power Corp., Rutland (USA)). 11 Sep 1973. 1p. Dep. NTIS $3.00.

**2229** (DOCKET-50271-238) VERMONT YANKEE NUCLEAR POWER STATION. Abnormal Occurrence No. AO-73-30: The Wear Pattern of Fuel Channels Is a Partial Impairment of Channel Flow. (Vermont Yankee Nuclear Power Corp., Rutland (USA)). 5 Oct 1973. 1p. Dep. NTIS $3.00.

**2230** (DOCKET-50271-239) VERMONT YANKEE NUCLEAR POWER STATION. Abnormal Occurrence Report No. AO-73-29: Malfunction of a Drywell High Pressure Switch (PS5-12A). (Vermont Yankee Nuclear Power Corp., Rutland (USA)). 3 Oct 1973. 1p. Dep. NTIS $3.00.

**2231** (DOCKET-50271-245) VERMONT YANKEE NUCLEAR POWER STATION. Pilgrim Nuclear Power Station, Unit 1. Determination with Respect to Need for Emergency Action. Safety Evaluation re Channel Box Wear. (Vermont Yankee Nuclear Power Corp., Rutland (USA)). 26 Oct 1973. 37p. (DOCKET-50293-196). Dep. NTIS $4.00.

**2232** (DOCKET-50271-341) VERMONT YANKEE NUCLEAR POWER STATION. Abnormal Occurrence Report No. AO-73-29: A Drywell High Pressure Switch (PS5-12A) Failed to Actuate at the Required Setpoint. (Vermont Yankee Nuclear Power Corp., Rutland (USA)). 10 Oct 1973. 2p. Dep. NTIS $3.00.

**2233** (DOCKET-50277-131) PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3. Blade Inspection Program for Determining Poison Tube Orientation. (Philadelphia Electric Co., Pa. (USA)). 22 Aug 1973. 33p. (DOCKET-50278-104). Dep. NTIS $3.75.

**2234** (DOCKET-50277-272) H. B. ROBINSON PLANT, UNIT 2. Abnormal Occurrence: During a Normal Startup There Was No Steam Flow Indication. (Carolina Power and Light Co., Raleigh, N. C. (USA)). 23 Oct 1973. 1p. Dep. NTIS $3.00.

**2235** (DOCKET-50280-181) SURRY POWER STATION, UNITS 1 AND 2. Quality Assurance Program. (Virginia Electric and Power Co., Richmond (USA)). 12 Sep 1973. 45p. (DOCKET-50281-150). Dep. NTIS $4.25.

**2236** (DOCKET-50280-187) SURRY POWER STATION, UNIT 1. Abnormal Occurrence: Main Steam Line Trip Valve TV-MS-101-C Closed During the Six Degree Partial Closure Test Resulting in Closure of both "A" and "B" Trip Valves. (Virginia Electric and Power Co., Richmond (USA)). 17 Oct 1973. 2p. Dep. NTIS $3.00.

**2237** (DOCKET-50281-136) SURRY POWER STATION, UNIT 2. Abnormal Occurrence Report AO-S2-73-07; Failure of Main Steam Trip Valve TV-MS-201B. (Virginia Electric and Power Co., Richmond (USA)). 16 Jul 1973. 7p. Dep. NTIS $3.00.

**2238** (DOCKET-50282-155) PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNIT 1. Abnormal Occurrence: Failure to Close the Fuel Transfer Tube Isolation Valve Prior to Commencing Refueling Pool Draining. (Northern States Power Co., Minneapolis, Minn.). 12 Sep 1973. 1p. Dep. NTIS $3.00.

As the result of an omission in the reactor vessel closure procedure following fuel loading, the transfer tube isolation valve was left open thus providing a path from the containment atmosphere to the outside. The procedure was modified to require a verification of valve closure. There was no potential for release of fission products during this occurrence. (JWR)

**2239** (DOCKET-50282-159) PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 AND 2. Interim Report of Loose Impeller Causing Seizing of Safety Injection Pump. (Northern States Power Co., Minneapolis, Minn. (USA)). 3 Oct 1973. 2p. (DOCKET-50306-133). Dep. NTIS $3.00.

**2240** (DOCKET-50282-161) PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNIT 1. Lapse in Thermoluminescent Dosimeter Monitoring of Background Radiation Levels. (Consolidated Edison Co. of New York, Inc., New York (USA)). 26 Sep 1973. 2p. Dep. NTIS $3.00.

2241 (DOCKET-50282-162) PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNIT 1. Containment Vessel Strength Test. (Northern States Power Co., Minneapolis, Minn. (USA)). 21 Sep 1973. 51p. Dep. NTIS $4.75.

2242 (DOCKET-50282-165) PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 AND 2. Interim Report on Westinghouse W-2 Switch Malfunction. (Northern States Power Co., Minneapolis, Minn. (USA)). 10 Oct 1973. 3p. (DOCKET-50306-135). Dep. NTIS $3.00.

During pre-operational testing of the safety injection and residual heat removal pumps, Westinghouse W-2 switches in the motor control circuits failed to close in the neutral position. This prevented the safety injection and residual heat removal pumps from starting on signal. The problem was traced to improper alignment of the spring and retainer subassembly in the switches. (JWR)

2243 (DOCKET-50282-166) PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNIT 1. Reactor Containment Building Integrated Leak Rate Test. (Northern States Power Co., Minneapolis, Minn. (USA)). 4 Oct 1973. 73p. Dep. NTIS $5.75.

2244 (DOCKET-50285-128) FORT CALHOUN STATION, UNIT 1. Abnormal Occurrence Report No. 73-3: No Flow Condition on the Steam Generator Blowdown Radiation Monitor. (Omaha Public Power District, Nebr. (USA)). 20 Sep 1973. 6p. Dep. NTIS $3.00.

2245 (DOCKET-50285-129) FORT CALHOUN STATION, UNIT 1. Abnormal Occurrence Report 73-4: Lockout Relays 86-1/T1A-3, 86-2/T1A-3, 86-1/T1A-4 and 86-2/T1A-4 Tripped. (Omaha Public Power District, Nebr. (USA)). 3 Oct 1973. 4p. Dep. NTIS $3.00.

2246 (DOCKET-50285-131) FORT CALHOUN STATION, UNIT 1. Unusual Event Report No. 73-2: Main Steam Line Rupture Caused by Steam Dump Valve Expansion Joint Failure. (Omaha Public Power District, Nebr. (USA)). 17 Oct 1973. 9p. Dep. NTIS $3.00.

2247 (DOCKET-50285-134) FORT CALHOUN STATION, UNIT 1. Unusual Event Report No. 73-3: Panel CB-4 Annunciator Dropped Rod Alarmed. (Omaha Public Power District, Nebr. (USA)). 23 Oct 1973. 5p. Dep. NTIS $3.00.

2248 (DOCKET-50286-100) INDIAN POINT STATION, UNIT 3. Review of the Design of Liquid Tanks that Contain Radioactivity with Regard to Possible Overflow. (Consolidated Edison Co. of New York, Inc., New York (USA)). 26 Sep 1973. 3p. Dep. NTIS $3.00.

2249 (DOCKET-50286-102) INDIAN POINT STATION, UNIT 3. Safety Evaluation Report. (Consolidated Edison Co. of New York, Inc., New York (USA)). 21 Sep 1973. 237p. Dep. NTIS $14.00.

Results of the radiological safety review are summarized and the scope of the technical details considered in evaluating the radiological safety aspects of the proposed plant operation are delineated. (FS)

2250 (DOCKET-50286-106) INDIAN POINT STATION, UNIT 3. Draft Environmental Statement. (Consolidated Edison Co. of New York, Inc., New York (USA)). Oct 1973. 546p. Dep. NTIS $29.50.

The environmental effects of construction and operation of the Indian Point Station, Unit 3 reactor are examined. The descriptions include: the environment in the area, including the history, geography, geology, hydrology, climatology, ecology, land and water use including chemical characteristics; the facility and its effluents; the impacts from construction and operation of the facility; alternatives to the proposed action; irreversible and irretrievable long-term commitments of resources from plant operation; need for power; and the benefits–cost analysis of the proposed plant operation. (FS)

2251 (DOCKET-50293-161) PILGRIM NUCLEAR POWER STATION, UNIT 1. License No. DPR-35, Amendment No. 1, High Condenser Cooling Water Differential Temperature. (Boston Edison Co., Mass. (USA)). 10 Jul 1973. 2p. Dep. NTIS $3.00.

2252 (DOCKET-50293-164) PILGRIM NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence Report AO-73-23: Malfunction of the Main Steam High Temperature Switches TS 261-15C and TS 261-16D. (Boston Edison Co., Mass. (USA)). 28 Jul 1973. 2p. Dep. NTIS $3.00.

2253 (DOCKET-50293-165) PILGRIM NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence Report AO-73-24: Malfunction of a Barton Model 288A Pressure Indicating Switch. (Boston Edison Co., Mass. (USA)). 31 Jul 1973. 1p. Dep. NTIS $3.00.

2254 (DOCKET-50293-167) PILGRIM NUCLEAR POWER STATION, UNIT 1. License DPR-35, Amendment 1. Unusual Occurrence UO-73-10: Motor Failure on Residual Heat Removal System Motor Operated Valve 1001-47. (Boston Edison Co., Mass. (USA)). 23 Aug 1973. 1p. Dep. NTIS $3.00.

2255 (DOCKET-50293-175) PILGRIM NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence AO-73-25: Malfunction of a Barksdale Model B2T-A12SS Pressure Switch. (Boston Edison Co., Mass.). 14 Aug 1973. 1p. Dep. NTIS $3.00.

During routine functional and calibration tests on the pressure switches for the Reactor High Pressure signals, one pressure switch was found to actuate at 1098 psig instead of the required ≤1085 psig. The problem was corrected by recalibration of the switch. (JWR)

2256 (DOCKET-50293-182) PILGRIM NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence: Malfunction of Barksdale Model B2TM12SS Pressure Switch. (Boston Edison Co., Mass. (USA)). 14 Sep 1973. 1p. Dep. NTIS $3.00.

During a routine calibration and functional surveillance test, a Barksdale pressure switch in the PCI circuit logic was found to actuate at 720 psig instead of the correct value of 900 ± 10 psig. The pressure switch was replaced and tested. (JWR)

2257 (DOCKET-50293-185) PILGRIM NUCLEAR POWER STATION, UNIT 1. Unusual Occurrence Report No. UO-73-13: During Operation of Diesel Generator B, a Cooling System Leak Was Observed from a Two-Inch Long Crack in the Cast Steel Inlet Casing of the Turbo-Charger. (Boston Edison Co., Mass. (USA)). 15 Sep 1973. 2p. Dep. NTIS $3.00.

2258 (DOCKET-50293-186) PILGRIM NUCLEAR POWER STATION, UNIT 1. Unusual Occurrence UO-73-14: The Reactor Building Vent Monitoring System Had an Incorrect Sample Valve Alignment. (Boston Edison Co., Mass. (USA)). 4 Oct 1973. 2p. Dep. NTIS $3.00.

The reactor building vent monitoring system was incorrectly operated in the purge mode for 22 hours due to the failure of the chemistry laboratory operator to switch to the operate position following a filter change. This monitoring system provides information only and has no active safety function. (JWR)

2259 (DOCKET-50293-187) PILGRIM NUCLEAR POWER STATION, UNIT 1. Unusual Occurrence UO-73-12: Failure of the Valve Operator Motor on the Outboard Isolation Valve (MO 1201-5) on the Inlet to the Reactor Water Clean-Up System. (Boston Edison Co., Mass. (USA)). 5 Sep 1973. 1p. Dep. NTIS $3.00.

2260 (DOCKET-50293-188) PILGRIM NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence AO-73-31: Setpoint Drift of Two Static-o-ring, Model 6N-AA3, Pressure Switches. (Boston Edison Co., Mass. (USA)). 19 Sep 1973. 1p. Dep. NTIS $3.00.

2261 (DOCKET-50293-190) PILGRIM NUCLEAR POWER STATION, UNIT 1. Results of Transient Reanalyses with End-of-Cycle Core Dynamic Characteristics. (Boston Edison Co., Mass. (USA)). 16 Oct 1973. 29p. Dep. NTIS $3.50.

2262 (DOCKET-50293-191) PILGRIM NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence Report No. AO-73-32: Malfunction of Switch No. 1 of LIS 263-72B. (Boston Edison Co., Mass. (USA)). 15 Oct 1973. 1p. Dep. NTIS $3.00.

2263 (DOCKET-50293-192) PILGRIM NUCLEAR POWER STATION, UNIT 1. Unusual Occurrence No. 73-15: Malfunction of Standby Gas Treatment System Discharge Damper. (Boston Edison Co., Mass. (USA)). 15 Oct 1973. 1p. Dep. NTIS $3.00.

2264 (DOCKET-50293-193) PILGRIM NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence Report AO-73-33: Malfunction of Pressure Switches PS 261-30A, B, C, and D. (Boston Edison Co., Mass. (USA)). 18 Oct 1973. 1p. Dep. NTIS $3.00.

2265 (DOCKET-50293-197) PILGRIM NUCLEAR POWER STATION, UNIT 1. Abnormal Occurrence Report No. AO-73-32: Set Point Drift of a Reactor Water Level Indicating Switch. (Boston Edison Co., Mass. (USA)). 24 Oct 1973. 2p. Dep. NTIS $3.00.

2266 (DOCKET-50295-165) ZION NUCLEAR PLANT, UNIT 1. Abnormal Occurrence: Erratic Operation of Diesel

Generator "O". (Commonwealth Edison Co., Zion, Ill. (USA)). 31 Aug 1973. 2p. Dep. NTIS $3.00.

During qualification testing the "O" diesel generator was started but the generator speed and output was observed to drop erratically. The problem was traced to a loose air fitting to the master trip device. The test was successfully completed after tightening the fitting. (JWR)

**2267** (DOCKET-50295-167) ZION NUCLEAR PLANT, UNIT 1. Abnormal Occurrence: Failure of Diesel Generator 1B. (Commonwealth Edison Co., Chicago, Ill. (USA)). 2 Jan 1973. 3p. Dep. NTIS $3.00.

**2268** (DOCKET-50295-168) ZION NUCLEAR PLANT, UNIT 1. Abnormal Occurrence: an Engineering Safeguards Actuation Occurred as a Result of a Coincidence Trip of Low Pressurized Level (1LC-460B) and Low Pressurized Pressure (1PC-455D). (Commonwealth Edison Co., Chicago, Ill. (USA)). 28 Jun 1973. 3p. Dep. NTIS $3.00.

**2269** (DOCKET-50295-169) ZION NUCLEAR PLANT, UNITS 1 AND 2. Incident Report: Auxiliary Feed Flow Indicator for 1D Steam Generator was Out of Calibration Resulting in a Tripped Reactor. (Commonwealth Edison Co., Zion, Ill. (USA)). 29 Jun 1973. 2p. (DOCKET-50304-116). Dep. NTIS $3.00.

**2270** (DOCKET-50295-173) ZION NUCLEAR PLANT, UNIT 1. Abnormal Occurrence: A Setpoint Change which Readjusts the Gain and Bias on the Turbine Impulse Chamber Pressure Modules was Found to be in Error. (Commonwealth Edison Co., Zion, Ill. (USA)). 26 Jul 1973. 3p. Dep. NTIS $3.00.

**2271** (DOCKET-50295-177) ZION NUCLEAR PLANT, UNIT 1. Abnormal Occurrence: Erratic Operation of Diesel Generator O, Addendum. (Commonwealth Edison Co., Chicago, Ill. (USA)). 18 Sep 1973. 1p. Dep. NTIS $3.00.

**2272** (DOCKET-50295-178) ZION NUCLEAR PLANT, UNIT 1. Abnormal Occurrence Report: Malfunction of the 1B Centrifugal Charging Pump 4KV Breaker. (Commonwealth Edison Co., Chicago, Ill. (USA)). 21 Sep 1973. 3p. Dep. NTIS $3.00.

**2273** (DOCKET-50295-183) ZION NUCLEAR PLANT, UNIT 1. Semiannual Report on Radioactive Waste and Environmental Monitoring, January–June 1973. (Commonwealth Edison Co., Chicago, Ill. (USA)). 26 Sep 1973. 64p. Dep. NTIS $5.25.

About $1.6 \times 10^{-4}$ Ci (excluding tritium) in liquid waste and a few pCi/sec of particulate radioactivity as airborne activity were released to the environment. Most of the particulate activity was not distinguishable from background origin. The gamma radiation dose, airborne radioiodine, particulate activity, and radioactivity in milk, grass, cattle feed, terrestrial deposition (rain, water, soil) and ground water are presented. (FS)

**2274** (DOCKET-50295-184) ZION NUCLEAR PLANT, UNIT 1. Abnormal Occurrence: Main Steam Check Valve Disc Stop Weld Cracking. (Commonwealth Edison Co., Chicago, Ill. (USA)). 5 Oct 1973. 4p. Dep. NTIS $3.00.

**2275** (DOCKET-50295-186) ZION NUCLEAR PLANT, UNIT 1. Abnormal Occurrence: Automatic Rod Withdrawal Caused the Station to Exceed its Maximum Licensed Power. (Commonwealth Edison Co., Chicago, Ill. (USA)). 16 Oct 1973. 3p. Dep. NTIS $3.00.

**2276** (DOCKET-50295-187) ZION NUCLEAR PLANT, UNIT 1. Abnormal Occurrence: Failure of Diesel Generators 1A and 1B to Start. (Commonwealth Edison Co., Chicago, Ill. (USA)). 18 Oct 1973. 2p. Dep. NTIS $3.00.

**2277** (DOCKET-50298-92) COOPER NUCLEAR STATION. Abnormal Occurrence: Electric Bus Failure. (Nebraska Public Power District, Columbus (USA)). 7 Sep 1973. 4p. Dep. NTIS $3.00.

**2278** (DOCKET-50301-106) POINT BEACH NUCLEAR POWER PLANT, UNIT 2. Abnormal Occurrence: Functional Failure of Containment Isolation Valve 2AOV-1296. (Wisconsin Electric Power Co., Milwaukee (USA)). 6 Aug 1973. 2p. Dep. NTIS $3.00.

**2279** (DOCKET-50304-126) ZION NUCLEAR PLANT, UNIT 2. Report on Structural Response of the Containment Structure. (Commonwealth Edison Co., Chicago, Ill. (USA)). 3 Oct 1973. 40p. Dep. NTIS $4.00.

**2280** (DOCKET-50305-107) KEWAUNEE NUCLEAR POWER PLANT. PIO-02-03, Analysis Report: Maximum Energy of Disc Impact Main Steam Check and Isolation Valves. (Nuclear Services Corp., Campbell, Calif. (USA)). 6 Sep 1973. 74p. Dep. NTIS $5.75.

The results of analyses to determine the maximum energy of impact of the main steam check and isolation valve discs for the Kewaunee Unit 1 Nuclear Power Plant, following a postulated pipe rupture are presented. The analyses were parametric in nature. Results were obtained for the check valve, with the check valve disc at a range of initial opening angles. Two different discs were examined to determine the effect of disc size and mass on the energy of impact. Analyses were also conducted for a spurious closure of the isolation valve. The maximum energy of impact of the check valve disc was found to be $1.177 \times 10^6$ in.-lb. The maximum for the isolation valve disc was found to be $1.197 \times 10^6$ in.-lb. The maximum energy of impact of the isolation valve disc for a spurious closure was found to be $0.151 \times 10^6$ in.-lb. (auth)

**2281** (DOCKET-50305-111) KEWAUNEE NUCLEAR POWER PLANT. Information re Cracking of the Stationary Breaker Position Switch on the 4160 Volt Switchgear. (Wisconsin Public Service Corp., Green Bay (USA)). 30 Aug 1973. 4p. Dep. NTIS $3.00.

**2282** (DOCKET-50305-114) KEWAUNEE NUCLEAR POWER PLANT. Abnormal Occurrence: Lightning Striking Within the Area of the Substation Resulted in High Voltage Spikes Being Induced into Plant Intelligence Circuitry. (Wisconsin Public Service Corp., Green Bay (USA)). 17 Sep 1973. 2p. Dep. NTIS $3.00.

**2283** (DOCKET-50309-139) MAINE YANKEE ATOMIC POWER PLANT. Abnormal Occurrence: When Station Service Was Transferred on Bus No. 2, the No. 2 Reserve Breaker (2R) Did Not Close and the No. 2 Unit Breaker (2U) Tripped De-Energizing Bus No. 2, Tripping Reactor Coolant Pumps Nos. 2 and 3, Resulting in a Low Flow Reactor Trip. (Maine Yankee Atomic Power Co., Wiscasset (USA)). 19 Sep 1973. 2p. Dep. NTIS $3.00.

**2284** (DOCKET-50309-145) MAINE YANKEE ATOMIC POWER PLANT. Abnormal Occurrence No. AO-73-3: Two Channels Were Found to be Operating With Trip Set Points Above the Required Minimum. (Maine Yankee Atomic Power Co., Wiscasset (USA)). 15 Oct 1973. 2p. Dep. NTIS $3.00.

**2285** (DOCKET-50313-107) ARKANSAS NUCLEAR ONE, UNIT 1. Abnormal Occurrence: Loss of Power to Vital Busses. (Arkansas Power and Light Co., Little Rock (USA)). 10 Sep 1973. 4p. Dep. NTIS $3.00.

**2286** (DOCKET-50317-129) CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS 1 AND 2. Final Report on Corrosion of Emergency Diesel Engine-Generator Sets. (Baltimore Gas and Electric Co., Md. (USA)). 3 Oct 1973. 3p. (DOCKET-50318-113). Dep. NTIS $3.00.

**2287** (DOCKET-50317-130) CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS 1 AND 2. Final Report on Buckling of Liner Plates in Spent Fuel Pools. (Baltimore Gas and Electric Co., Md. (USA)). 1 Oct 1973. 3p. (DOCKET-50318-114). Dep. NTIS $3.00.

**2288** (DOCKET-50317-134) CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS 1 AND 2. Damage to Spent Fuel Pool Cooling Return Line. (Baltimore Gas and Electric Co., Md. (USA)). 2 Nov 1973. 3p. (DOCKET-50318-116). Dep. NTIS $3.00.

**2289** (DOCKET-50327-53) SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2. Cracks in the Bodies of the Jacket-Water Temperature Regulating Valves Were Found on Both Diesel Generator Engines of Unit 2A-A. (Tennessee Valley Authority, Chattanooga (USA)). 2 Jul 1973. 1p. (DOCKET-50328-47). Dep. NTIS $3.00.

**2290** (DOCKET-50327-54) SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2. Semiannual Report on Environmental Radioactivity Levels, February–July 1972. (Tennessee Valley Authority, Chattanooga (USA)). 24 Sep 1973. 41p. (DOCKET-50328-48). Dep. NTIS $4.25.

**2291** (DOCKET-50331-115) DUANE ARNOLD ENERGY CENTER. Repair of Main Steam Pipe Surface Defects. (Iowa Electric Light and Power Co., Cedar Rapids (USA)). 3 Jan 1973. 1p. Dep. NTIS $3.00.

**2292** (DOCKET-50336-78) MILLSTONE NUCLEAR POWER STATION, UNIT 2. License Application, FSAR, Amendment 22. (Millstone Point Co., Hartford, Conn. (USA)). 15 Oct. 1973. 96p. Dep. NTIS $7.00.

**2293** (DOCKET-50336-81) MILLSTONE NUCLEAR POWER STATION, UNIT 2. Final Report for Deficiency Report No. 5 on

Damaged Stress Cone. (Millstone Point Co., Hartford, Conn. (USA)). 26 Sep 1973. 3p. Dep. NTIS $3.00.

**2294** (DOCKET-50338-93) NORTH ANNA POWER STATION, UNITS 1 AND 2. Report on Rock Conditions and Their Reinforcement in Containment and Fuel Building Excavations. (Virginia Electric and Power Co., Richmond (USA)). 15 Oct 1973. 71p. (DOCKET-50339-90). Dep. NTIS $5.75.

**2295** (DOCKET-50341-73) ENRICO FERMI ATOMIC POWER PLANT, UNIT 2. Deficiency Report No. 3.2, Reactor Pressure Vessel Flange Distortion. (Detroit Edison Co., Mich. (USA)). 11 Oct 1973. 12p. Dep. NTIS $3.00.

**2296** (DOCKET-50344-78) TROJAN NUCLEAR PLANT. Design for Pipe Break Effects. (Portland General Electric Co., Oreg. (USA)). 18 Sep 1973. 69p. (BN-TOP-2(Rev. 1)). Dep. NTIS $5.50.

Techniques are described which are used to analyze fluid jet impingement loads and to establish design criteria for pipe restraints provided to prevent damage from pipe whip effects resulting from postulated pipe breaks in nuclear power plants. (auth)

**2297** (DOCKET-50358-51) WM. H. ZIMMER NUCLEAR POWER STATION, UNIT 1. Ecological Baseline Studies, Semiannual Progress Report, January 8–July 14, 1973. (Cincinnati Gas and Electric Co., Ohio (USA)). 14 Sep 1973. 190p. Dep. NTIS $11.50.

Aquatic studies taking place in the Ohio River, Little Indian Creek and Big Indian Creek and terrestrial studies confined to a five mile radius of the nuclear plant are presented. Aquatic parameters include phytoplankton, zooplankton, benthos, fish, periphyton, physical properties, and chemical constituents of the waters. Terrestrial studies include vegetation, mammals, insects, reptiles, amphibians, birds, and soil. (FS)

**2298** (DOCKET-50367-44) BAILLY GENERATING STATION. Specifications for Ecological Monitoring Programs. (Northern Indiana Public Service Co., Hammond (USA)). 17 Oct 1973. 47p. Dep. NTIS $4.50.

**2299** (DOCKET-50409-64) LACROSSE BOILING WATER REACTOR. Abnormal Occurrence No. 73-3: Control Rod Drive Mechanism No. 4, Failure to Scram Hydraulically; Abnormal Occurrence No. 73-4: Control Rod Drive Mechanism No. 26, Failure to Scram Hydraulically; Abnormal Occurrence No. 73-5: Control Rod Drive Mechanism No. 11, Failure to Scram Hydraulically; Abnormal Occurrence No. 73-6: Control Rod Drive Mechanism No. 13, Failure to Scram Hydraulically. (Dairyland Power Cooperative, La Crosse, Wis. (USA)). 6 Sep 1973. 10p. Dep. NTIS $3.00.

**2300** (DOCKET-50409-68) LACROSSE BOILING WATER REACTOR. Monthly Operating Report, July 1973. (Dairyland Power Cooperative, La Crosse, Wis. (USA)). 1973. 35p. (DPC-851-62). Dep. NTIS $3.75.

**2301** (DOCKET-50413-51) CATAWBA NUCLEAR STATION, UNITS 1 AND 2. AEC Safety Evaluation Report. (Duke Power Co., Charlotte, N. C. (USA)). 12 Oct 1973. 252p. (DOCKET-50414-51). Dep. NTIS $14.75.

**2302** (DOCKET-50458-1) RIVER BEND STATION, UNITS 1 AND 2. License Application. (Gulf States Utilities Co., Beaumont, Tex. (USA)). 18 Sep 1973. 171p. (DOCKET-50459-1). Dep. NTIS $10.75.

**2303** (PRDI-73-1) TITLE LISTING OF POWER REACTOR DOCKET INFORMATION, JULY–AUGUST 1973. (USAEC Technical Information Center, Oak Ridge, Tenn.). Oct 1973. 42p. TIC Free.

Citations and subject indexing to the documentation associated with civilian nuclear power plants are presented. This material is that which is submitted to the Atomic Energy Commission in support of applications for construction and operating licenses. Citations are listed by Docket number in accession number sequence. The Table of Contents is arranged both by Docket number and by nuclear power plant name. (DCC)

**2304** (RAI-73-9) REGULATORY ADJUDICATION ISSUANCES, SEPTEMBER 1973. (USAEC Technical Information Center, Oak Ridge, Tenn.). 15 Oct 1973. 195p. TIC $1.25.

Issuances received from the U.S. Atomic Energy Commission, the Atomic Safety and Licensing Boards, and the Atomic Safety and Licensing Appeal Boards are presented. (FS)

**2305** (WCAP-8110(Suppl. 2)) TEST PLANS AND RESULTS FOR THE ICE CONDENSER SYSTEM. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). 19 Jun 1973. 45p.

Confirmatory tests are described and results are presented concerning top deck door dynamics, a quarter scale model, and lower inlet door thermal and leakage tests. (FS)

**2306** (WCAP-8110(Suppl. 3)) TEST PLANS AND RESULTS FOR THE ICE CONDENSER SYSTEM. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). 18 Jul 1973. 37p.

Confirmatory tests and test results are presented for dynamic testing of a prototype intermediate deck door hinge and frame assembly and a lower inlet shock absorber. (FS)

# GENERAL

## Civilian Defense

*Refer also to abstract 350.*

## Energy Utilization and Economics

**2307** (BNL-17894) PREDICTED CHARACTERISTICS OF SUPERCONDUCTING TRANSMISSION CABLES. Forsyth, E. B. (Brookhaven National Lab., Upton, N.Y. (USA)). [nd]. 7p. (CONF-731107-1). Dep. NTIS $3.00.

From conference on high voltage DC and/or AC power transmission; London, UK (19 Nov 1973).

A self-contained superconducting cable is under development in West Germany. Superconducting versions of both compressed gas-insulated and pipe-type cables are being investigated in the US. Basic measurements have been made of the properties of the conductor and insulating materials and of helium for cable cooling systems. Based on this information, it has been shown that superconducting ac cables possess very desirable electrical characteristics. Impedance matching to existing multiple circuit overhead installations operating between 1 to 3 times SIL should be possible. This is an attribute shared by no other underground cable technology. Performance of these cables under fault conditions is hard to predict without further experimental work. The overload characteristics will be superior to conventional cables. All cost estimates are tentative, but based on the ones that have been made ac superconducting cables may become economically attractive above 2 GVA. Superconducting dc cables appear to be a feasible extension of ac cable design, but the great distances necessary for economic optimization will probably preclude an early application unless converter costs are drastically reduced. Many technical problems have to be solved before viable superconducting cables can be presented to the system planners. The design of low cost, reliable and long-life cryostats is a formidable problem. There is a dearth of information on dielectric behavior at cryogenic temperatures, particularly on a long-term degradation. (auth)

**2308** (CONF-731105-4) SAFETY AND ENVIRONMENTAL PROBLEMS POSED BY OPERATION OF A POTASSIUM VAPOR TOPPING CYCLE. Fraas, A. P. (Oak Ridge National Lab., Tenn. (USA)). 1973. 19p. Dep. NTIS $3.00.

From winter meeting of American Society of Mechanical Engineers; Detroit, Michigan, USA (11 Nov 1973).

A review of the special operational, maintenance, and environmental problems posed by a fossil fuel-fired potassium vapor cycle plant indicates that such a system, if well designed, would present unusual and difficult but manageable problems. Leaks should be inherently slow to develop, and relatively simple, reliable instrumentation techniques of adequate sensitivity are available to detect them. The attendant operational and maintenance problems appear to be reasonably tractable. Under routine operating conditions, the gaseous and thermal emissions to the environment should be very low. The worst accident from the standpoint of the public would be the release of a substantial fraction of the potassium inventory to the atmosphere. It appears that such an accident would release about the same amount of alkali metal as the oxide as goes out the stack each day as a sulfate from a conventional coal-fired plant fitted with good fly ash precipitators. (auth)

**2309** (CONF-731105-5) POLLUTION CONTROL ENERGY COSTS. Hirst, E. (Oak Ridge National Lab., Tenn. (USA)). 1973. 28p. Dep. NTIS $3.50.

From winter meeting of American Society of Mechanical Engineers; Detroit, Michigan, USA (11 Nov 1973).

The amounts of energy needed for or saved by operation of several environmental protection strategies are examined. The areas considered include: urban passenger traffic, waste water treatment, solid waste management, air-pollution control, and waste heat dissipation. The energy required to meet the environmental needs discussed—based on the limitations and assumptions in this study—are small relative to total energy use. (auth)

**2310** (LA-5406-MS) SODIUM: CLEAN-ENERGY STORAGE MEDIUM FOR VEHICULAR POWER. Brown, W. K. (Los Alamos Scientific Lab., N. Mex. (USA)). Sep 1973. Contract W-7405-eng-36. 10p. Dep. NTIS $4.00.

Metallic sodium is proposed as an energy storage medium to provide pollution-free power for virtually all forms of land, sea, and air transportation. Ideally, electrical energy from efficient, central, nuclear-powered plants would be used in the reduction of ordinary salt to sodium, which would subsequently be carried in vehicles and reacted with water to produce mechanical energy in a hydrogen-fueled engine. Lye, the sole combustion product, would be recycled for continuing use. The scheme appears to offer a competitive alternative to the use of cryogenic hydrogen for vehicular power. (auth)

**2311** (LRP-63/73) ENERGY. Bibliographic Compilation and Calculation of the Resources, Consumption, and Wastes in the World. Roux, M. (Ecole Polytechnique Federale de Lausanne (Switzerland)). Jul 1973. 66p. (In French). Dep. NTIS (U.S. Sales Only) $5.50.

The available resources of fossil and nuclear fuels as well as those of solar energy, hydroelectric power and others are reviewed and compared to the global consumption of energy in the world, the USA, the Common Market and Switzerland. Without fission breeder reactors or thermonuclear fusion reactors, the world would be short of energy within a few centuries. The per capita and global consumption, together with its growth rate, is presented and distributed with respect to primary energy sources and/or main sectors of use. Attention is focussed on the energy required by the generation of electrical power. Estimates up to the year 2000 are also given. Due to a twofold increase both in the world population and in the per capita consumption, the energy demand by the year 2000 will be four times higher than its present level. Countries presently well-developed will show a lesser growth. Chemical and radioactive nuclear wastes resulting from the global energy consumption or the production of electrical power are tabulated and scaled to the energy consumption. Wastes from the nuclear economy are estimated up to the year 2000. The relative biological hazards pertaining to the radioactive inventories and wastes of fission reactors are compared to those of a reference fusion reactor. Appendix A presents information concerning units, exposures, concentrations and biological effects of radiation along with potential dangers of fission or fusion reactors. Appendix B lists the heats of combustion of fossil and nuclear fuels and defines some dimensions often encountered in the literature. An extensive bibliography is attached to this report. (14 tables, 75 references) (auth)

**2312** (ORNL-EIS-73-52(Vol.1)(No.10)) NSF-RANN ENERGY ABSTRACTS. A Monthly Abstract Journal of Energy Research. Guthrie, M. P. (Ed.). (Oak Ridge National Lab., Tenn. (USA)). Oct 1973. Contract W-7405-eng-26. 24p. Dep. NTIS $3.25.

Eighty-one papers are cited in the bibliography on research and analyses pertaining to energy sources, electric power (generation, supply and demand, transmission, environmental effects, and use), and energy (production, consumption, supply and demand, and policy). The research publications cited are technical journal articles, popular or semi-technical magazine articles, topical reports, progress reports, symposium papers and proceedings, monographs, and books published within the past two years. (MCW)

**2313** NUCLEAR PLANT. Genswein-Schmitt, A. German Patent 1,613,117. 14 Jan 1971. Filed date 10 Aug 1967. (In German).

The design is given of a nuclear installation destined for fission and also fusion with a closed gas coolant circuit and gas turbines. The working gas is strongly ionized by nuclear radiation and is accelerated and compressed thermodynamically by continuous electric power coming from the exterior and by thermal energy. These processes take place in common blast pipe of a stationary reactor in which the reaction processes (fusion and fission) are developed in the corresponding reactor installation. (TSS)

**2314** CLEAN STACK GAS GETS TOP PRIORITY AND AWARD AT DUQUESNE. Power; 117: No. 7, 34-35(Jul 1973).

A new system was installed at the Phillips and Elrama Power Stations for flue-gas scrubbing systems and will supplement existing mechanical and electrostatic dust collectors. A description of the Chemico venturi wet scrubber is given. The two-stage operation removes particulates and then removes $SO_2$. An environmental award has been presented at Duquesne for this work. (MCW)

**2315** OIL SHALE IN THE ENERGY WINGS. Pub. Util. Fortn.; 92: No. 10, 65-66(8 Nov 1973).

The world's largest oil shale reserves are found in the Green River formation of Colorado, Utah, and Wyoming, containing an estimated 1.8 trillion barrels of oil, of which approximately 600 billion barrels can be developed with the present technology. Crude shale oil can be hydrotreated at the mine site. As a premium fuel oil it either can be blended with high sulfur stocks to yield fuels meeting environmental specifications or can be used as fuel for stationary gas turbine plants. As a premium feedstock it can be used to produce gasoline and fuel oils in a simple, low-cost refinery operation. Hydrotreated shale oil naphtha can be marketed as a feedstock for SNG manufacture. (MCW)

2316 PLUMBING THE OCEAN DEPTHS: A NEW SOURCE OF POWER. Lavi, A.; Zener, C. (Carnegie-Mellon Univ., Pittsburgh). IEEE (Inst. Elec. Electron. Eng.), Spectrum; 10: No. 10, 22-27(Oct 1973).

The main difficulty in harnessing solar energy is collecting it. The collection mechanism for solar sea power is the ocean. Solar energy, absorbed by the surface waters of tropical oceans, can be converted first into electric power by solar sea power plants, then converted by electrolysis into chemical energy, and transported by ship for distribution to heat homes, power transportation facilities, and form a basic ingredient in materials processing. The problems involved for a SSPP are insufficient temperature difference, corrosiveness of sea water, microbial fouling, plant anchoring, diluteness of solar energy in the ocean, and environmental effects. (MCW)

2317 TRANSPORTATION ENERGY USE AND CONSERVATION POTENTIAL. Hirst, E. (Oak Ridge National Lab., TN). Bull. At. Sci.; 29: No. 9, 36-42(Nov 1973).

Traffic, energy consumption, and energy intensiveness for inter-city freight and passenger traffic and urban passenger traffic are discussed. Transportation of people and goods consumes one-fourth of the total U. S. energy budget. Ninety percent of the world oil supply will have been consumed by about 2025 and ninety percent of U. S. oil reserves within 30 years. U. S. transportation is almost entirely dependent on oil as a fuel. Exploration, production, transportation, refining, and use of petroleum present serious environmental problems. Transportation contributes to a number of other environmental problems including urban congestion, inefficient land use, and noise. These facts support the urgent need for an examination of transportation energy use. (MCW)

2318 ENERGY PROBLEMS AND ENVIRONMENTAL CONCERN. Train, R. E. (Environmental Protection Agency, Washington, DC). Bull. At. Sci.; 29: No. 9, 43-47(Nov 1973).

The assertion that the energy crisis blame lies solely on environmentalists' blockage of new generating facilities and new refinery capacity is discussed. Blame involves other factors including prices, technology, regulatory requirements, international relations, and national security considerations. The consumer's role is discussed. Energy efficiency labels for major home appliances, automobiles, and automobile accessories are needed. A comparison of new-car gasoline mileage performance has been published by the EPA. (MCW)

2319 CAMPUS CENTRAL PLANT HEATS AND COOLS. Whitaker, L. E. Power; 117: No. 7, 28-29(Jul 1973).

The University of Oklahoma Health Sciences Center's central heating and cooling plant is expanding to serve a growing complex of public and private institutions in Oklahoma City. It serves a 245-acre campus site. The design features are described. The central-plant system uses two steam-turbine-driven centrifugals with 3000 tons total cooling capacity. Dry saturated steam is produced by two natural-gas-fired boilers. Fuel oil, stored in tanks capable of holding 100,000 gallons, is used as a standby source of energy. Piping systems and rates and controls are discussed very briefly. (MCW)

2320 LOGARITHMIC CENTURY. Lapp, R. E. Englewood Cliffs, NJ; Prentice-Hall, Inc. (1973). 268p. $7.95.

Limitations that must be placed on the consumption of the world's fuels are discussed. The evidence causing the exponential growth in this century is discussed, including such factors as the automobile and cigarette industries. A technological society cannot exist without fuels. The author believes that the alternative answer to the energy crisis is atomic fusion. The nine chapters are: America's Growth— End in Sight?; Hell on Wheels; The Great Burnup, which is a discussion of change from the use of the renewable fuel wood to coal; The Growth of Nuclear Power; The Consumer Avalanche; The Knowledge Explosion; The Question of Growth; The Control of Technology; and The Affluent Island, which describes the affluence of the United States in its per capita use of products as compared to the remainder of the world. (MCW)

2321 OPTIMIZATION OF COAL GASIFICATION PROCESSES FOR SYNTHETIC NATURAL GAS PRODUCTION. Li, C. T. H. Morgantown, WV; West Virginia Univ. (1973). 181p. University Microfilms Order No. 73-23,882. Thesis (Ph. D.).

Eleven alternate coal gasification processes to produce 250 billion Btu per day of synthetic natural gas were calculated and the performances of the different processes were compared, based on their optimal thermal efficiencies. In order to optimize the thermal efficiency of each alternate, thermal dynamical models for the alternates were first constructed according to specifications provided by the Office of Coal Research for the synthetic natural gas production. By applying the "Complete Technique for Optimization" the optimal thermal efficiencies were computed. The prices of synthetic natural gas produced from the different alternate processes were also calculated, based on the results of sub-system equipment design optimizations and using the standardized O. C. R.—A. G. A. accounting procedure. Since the raw material (coal) cost constitutes a large portion of the final gas price, the process with the largest thermal efficiency was found also to have the lowest final gas price. The process that utilizes most of the volatile matter of coal and produces the most methane in the gasification stage, rather than in the final methanation stage, was found to have higher thermal efficiencies. To effectively produce methane in the gasification stage, a hydrogenolysis and hydrogenation of the raw coal in a hydrogen-rich atmosphere are desirable. This hydrogen is generated by gasifying the hydrogenated coal residue, then shifting and purifying the produced synthesis gas. (Diss. Abstr. Int., B)

2322 COAL GASIFICATION: HOW BEST, HOW SOON. Chem. Eng. News; 51: No. 46, 18-19(12 Nov 1973).

The six processes now being considered in the development program sponsored by the Office of Coal Research and the American Gas Association are discussed briefly, and the present status of each is revealed. The two most advanced, the Lurgi in Westfield, Scotland (see Chem. Eng. News, Nov. 5, 1973) and the Hygas in Chicago, have operated in pilot-plant stages. Trials on the first of four types of coal in the former have been completed, but disclosure of results will await completion of tests on the other three in the Spring of 1974. The Hygas plant, operating on Montana lignite (22 tests, 2000 tons) has produced pipeline-quality gas with a heating value of ~1000 Btu/s.c.f. Most of the other processes will be entering the pilot stages within the next 18 months, and an evaluation of all pilot-plant results will likely determine the future of the gasification industry's character. The most optimistic projections indicate that the first commercial plant could be built by 1978, but most observers believe that no significant quantities of synthetic pipeline gas will be available before 1985. (LMT)

## Information Handling

2323 TELEDOCUMENTATION NETWORK FOR EUROPE. Romerio, G. F. (ESRO-ELDO, Paris). Euro-Spectra; 12: No. 1, 12-25(Mar 1973).

The SDS/RECON teledocumentation network is presented, and the advantages of a conversational on-line system are exemplified by describing a very simple bibliographical search strategy. The software/hardware aspects of the system and the user/system interface are analyzed, with emphasis on the flexibility of the RECON retrieval language. (auth)

## Law

*Refer also to abstracts 437, 438, and 685.*

2324 (DHEW-73-8015) REGULATIONS FOR THE ADMINISTRATION AND ENFORCEMENT OF THE RADIATION CONTROL FOR HEALTH AND SAFETY ACT OF 1968. (Bureau of Radiological Health, Rockville, Md. (USA)). Nov 1972. 43p. (BRH/OBD-73-5). GPO $0.45.

The purpose of the Radiation Control for Health and Safety Act is to protect the public from unnecessary exposure to radiation from electronic products. Radiation covered was defined to mean any ionizing or nonionizing electromagnetic or particulate radiation or any sonic, infrasonic, or ultrasonic wave emitted from an electronic product as the result of the operation of an electronic circuit in such product. The provisions of the Act give the Secretary, Department of Health, Education, and Welfare, authority to establish and carry out an electronic product radiation control program, which shall include performance standards for electronic products. The regulations contained herein were promulgated under that authority. The Bureau of Radiological Health retains the authority for the day-to-day operation in carrying out the Act's mandate for an electronic product radiation control program. This compilation is revised periodically, and efforts are made to provide an accurate reproduction of the regulations up to the date of this publication. This publication contains those regulations published in the FEDERAL REGISTER from June 4, 1969 through September 30, 1972. (CH)

**2325** PROTECTION AGAINST IONIZING RADIATION. A Survey of Current World Legislation. Int. Dig. Health Legislation; 22: 623-946(1971).

This survey of existing legislation on protection against ionizing radiations is based on such source material as was available, for each of the countries concerned, at the Headquarters of the World Health Organization up to the end of November 1971. As with all such surveys, it is not intended to provide an exhaustive coverage of world legislation in the field in question, but to give typical examples of the form that such legislation has taken. It should be pointed out that the legislation in this field is in a state of rapid development and that changes are frequently being made; for this reason, it is possible that the survey may not, in certain respects, be completely up to date. (INIS)

**2326** AGREEMENT BETWEEN THE INTERNATIONAL ATOMIC ENERGY AGENCY, JAPAN AND AUSTRALIA FOR THE APPLICATION OF AGENCY SAFEGUARDS IN RESPECT OF THE AGREEMENT BETWEEN THOSE GOVERNMENTS FOR CO-OPERATION IN THE PEACEFUL USES OF ATOMIC ENERGY. Treaty Series 172, No. 10. Canberra; Australian Government Publishing Service (1973). 10p.

Japan and Australia undertake to use for peaceful purposes only, any nuclear materials, equipment or facilities required to be listed in their respective Inventories. The IAEA undertakes to apply its safeguards to verify this. Application of safeguards and safeguards procedures are detailed. (AT)

## Management

*Refer also to abstracts 624 and 626.*

**2327** (JUL-952-ST) HEALTH PHYSICS DIVISION ANNUAL REPORT 1972. Keller, M.; Tzschaschel, R. (eds.). (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralabteilung Strahlenschutz). May 1973. 171p. (In German). Dep. NTIS (U. S. Sales Only) $10.75.

The Health Physics Division of the Nuclear Research Establishment, Jülich, is responsible for radiation protection activities at installations, for personnel, and for the environment. This includes the organization, as well as the permanent development of measuring methods and procedures according to the most recent knowledge of science and research. A complete bibliography of all the published and internal literature of the division in 1972 is included. (CH)

**2328** (UCID-30047(Rev. 1)) CATALOG OF LLL COMPUTER DOCUMENTATION REPORTS. Norem, W. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jul 1973. Contract W-7405-eng-48. 404p. Dep. NTIS $22.25.

A catalog of all unclassified reports issued by the Lawrence Livermore Laboratory and pertaining to computer documentation is given. The reports primarily deal with computers and programs of the Livermore Time-Sharing System. (auth)

**2329** RADIATION EMERGENCY ASSISTANCE. A Guide to Available State and Federal Radiation Emergency Response Resources in the Western States. Lakewood, CO; Western Interstate Nuclear Board (1973). 52p.

Assistance available through the mutual aid provisions of the Western Interstate Nuclear Compact in the event of nuclear accidents within the territory are briefly described. It is pointed out that domestic radiation incidents are the responsibility of State radiation control agencies, but that the magnitude of a problem might require the cooperation of other State agencies and also those of adjacent States. An essential element of effective response to a domestic nuclear incident is contingency planning that gives consideration to all credible potential emergencies that may arise and which prescribes appropriate procedures for each. (CH)

## Mathematics and Computers

*Refer also to abstracts 908, 2328, and 2405.*

**2330** (BNWL-1708) TRANSMISSIVITY ITERATIVE PROGRAM USER'S MANUAL. Addison, L. E.; Friedrichs, D. R.; Kipp, K. L. (Battelle Pacific Northwest Labs., Richland, Wash.). 1972. Contract AT(45-1)-1830. 213p. Dep. NTIS $7.60.

This user's manual contains listings and functional definitions of the various directives available in the Iterative Sequence. These directives are used to operate the Iterative Sequence and to direct and complete the actual analysis. A complete and thorough description of each directive is contained in the report, "The Transmissivity Iterative Programs on the PDP-9: A Man-Machine Interactive System," BNWL-1707. (auth)

**2331** (COO-3077-31) PRELIMINARY REPORT ON CIMS PL/I. Abrahams, P. (New York Univ., N.Y. (USA). Courant Inst. of Mathematical Sciences). Aug 1973. Contract AT(11-1)-3077. 71p. Dep. NTIS $5.75.

CIMS PL/I is an implementation of a PL/I subset on the CDC 6600 computer. The subset is oriented towards compiler writing, and is sufficiently large so that the compiler itself could be conveniently written in it. The objective of this report is to set forth some of the more interesting aspects of the compiler and some of the conclusions drawn from creating it. (auth)

**2332** (DP-MS-73-47) SAVANNAH RIVER POST INSTALLATION REVIEW SYSTEM/360 MODEL 195K. Hartshorn, W. R. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.)). 14 Jun 1973. Contract AT(07-2)-1. 15p. (CONF-731023-1). Dep. NTIS $3.00.

From 9th AESOP meeting; San Francisco, California, USA (1 Oct 1973).

**2333** (HMI-B-140) CAMAC BRANCH CONTROLLER FOR PROGRAMMABLE READ-ONLY-MEMORIES (PROM-BDC). Part 1. Operation and Programming. Part 2. Assembler for Simplification of Programming. Herdam, G.; Kubitz, M. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F.R. Germany)). Sep 1973. 48p. (In German). Dep. NTIS (U.S. Sales Only) $4.50.

In simple measuring systems with automatical acquisition and protocol of data the CAMAC-instrumentation system may be used. The program controlling the process consists of 256 words in maximum and is stored in a programmable read-only-memory (PROM). The controller takes each word of the program from the memory in parallel and is performing a corresponding operation. An assembler especially developed for this controller can be used for the simplification of programming. (auth)

**2334** (HMI-B-141) DEVICE FOR AUTOMATIC LOADING OF THE INITIAL BOOTSTRAP PROGRAM VIA THE DMA-CHANNEL OF THE COMPUTER SIEMENS 301. Abend, P.; Becker, H. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F.R. Germany)). Sep 1973. 20p. (In German). Dep. NTIS (U.S. Sales Only) $3.00.

A device was developed which allows to load automatically the initial bootstrap program of the Computer S 301 from memory address 37712 octal to 37740 octal by means of a push button at the control panel of the Computer. The bootstrap loader is inserted into the DMA-channel between the DMA-port and the channel-multiplexer, or any other peripheral device linked to the DMA-port. Thereby, no subchannels are lost. By pressing the pushbutton BOOTSTRAP (earlier: CHECKING LAMPS), the channel-multiplexer is switched off the DMA-port, and under control of the signals ADST, SCHR, EABF the bootstrap program stored in a programmable read only memory, is then written into the memory of the computer. After transmission of the bootstrap program the channel-multiplexer is again linked to the DMA-port. (auth)

**2335** (IS-3238) ALGORITHM FOR REDUCING THE NORM OF THE RESIDUAL VECTOR. Lambert, R. J.; Conker, R. S. (Ames Lab., Iowa (USA)). Nov 1973. Contract W-7405-eng-82. 9p. Dep. NTIS $3.00.

An algorithm is developed for reducing the norm of the residual vector $r = Ax - \mu x$ where $\mu$ is the Rayleigh quotient $x'Ax$ associated with the real symmetric matrix A and the unit vector x. A procedure is outlined for finding a change vector g such that the vector $x_1 = (x + g)/||x + g||$ produces a residual vector $r_1 = Ax_1 - \mu_1 x_1$ with $\mu_1 = x_1'Ax_1$ which has a smaller norm than does r. The procedure also can be used to find matrix eigenvectors because it leads to two different computational methods for producing a sequence $\{r_m\}$, $m = 0, 1, 2, \ldots$, which tends to zero as $m \to \infty$. Convergence is quite rapid. As a complete eigenvalue and eigenvector procedure, the method has been programmed and thoroughly tested on the test matrices of the EISPAC set and, at the current stage of development, it is considerably faster than EIGEN and somewhat slower than Wilkinson's TRED2-TQL2 procedure. The final eigenvalues and eigenvectors generally are slightly better as measured by the norm of the residuals as compared to Wilkinson's. (auth)

**2336** (KHFTI-73-2) ESTIMATION OF UNKNOWN PARAMETERS BASED ON EXPERIMENTAL DATA. Koltunov, I. A. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1973. 12p. (In Russian). Dep. NTIS (U.S. Sales Only) $3.00.

Experimental data are assumed to represent realization of system of random values $X_i$($\iota = 1,2, \ldots, n$), having common density of the distribution ($X_1, \ldots, X_n, \alpha_1, \ldots, \alpha_n$), which is given with an accuracy to the parameters values $\alpha_k$($K = 1, \ldots, n$). It is often necessary to predict the probable parameters values $X_\iota$ ($\iota = 1, \ldots, n$) from estimation of the parameters ($\alpha_1, \ldots, \alpha_n$). This paper presents the methods of estimation of a set of unknown parameters, based on introducing the so-called generalized effective values. (auth)

**2337** (SLA-73-866) USERS MANUAL FOR EPAD1 AND EPAD2: COMPUTER PROGRAMS FOR STATIC ELASTOPLASTIC STRESS ANALYSIS. Benzley, S. E.; Burchett, S. N.; Beisinger, Z. E. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1973. Contract AT(29-1)-789. 53p. Dep. NTIS $4.75.

EPAD is a finite-element program for the static elastoplastic stress analysis of arbitrary bodies of revolution subjected to either symmetrical or unsymmetrical loadings. EPAD1 and EPAD2 incorporate the original version of EPAD (AFWL-TR-69-146) with an automatic mesh generation program and an output plotting package. (LMT)

**2338** (SLA-73-5468) PCM DATA SEQUENCE CONTROLLER. Johnson, C. S. (Sandia Labs., Albuquierque, N. Mex. (USA)). [nd]. 9p. (CONF-731016-1). Dep. NTIS $3.00.

From international telemetering conference; Washington, District of Columbia, USA (9 Oct 1973).

The PCM Data Sequence Controller is used to interface a memory-controlled PCM encoder with a plated wire memory to form a unique digital data compression and storage system. The memory-controlled PCM encoder is used to select formats and convert input analog data channels into a PCM bit stream which is both transmitted and stored in a plated wire memory. The encoder is also used to retrieve information from the plated wire memory and retransmit it. The system provides both temporary and permanent data storage for the telemetering of data in a severe environment. (auth)

**2339** (SLL-73-275) COMPUTER-DETECTED ERRORS IN THE MAGNETIC TAPE VERSION OF THE JCPDS X-RAY POWDER DIFFRACTION FILE (SETS 1-22). Nichols, M. C. (Sandia Labs., Livermore, Calif. (USA)). Oct 1973. Contract AT(29-1)-789. 14p. Dep. NTIS $3.00.

The x-ray powder-diffraction data file of the JCPDS (Joint Committee for Powder Diffraction Standards) exists presently in two primary forms. One is the 3″ × 5″ cards on which the principal data has been published for many years. The other form is the JCPDS magnetic tape which is now used for the preparation of index books as well as for distribution for use with various computerized powder pattern identification programs. The data present on the magnetic tape is derived from the information on the 3″ × 5″ cards so that the cards are the prime reference source for the magnetic tape. During computer processing of the powder diffraction data as supplied by the JCPDS a number of possible deficiencies, inconsistencies and errors were discovered in the magnetic tape version of the file; these errors are listed in Table I. A previous report (SCL-DR-70-48) discussed prior errors, the sources of these errors, and the computer programs developed to detect them. This report lists and discusses the additional errors found. (auth)

**2340** (UCID-30077) EISPACK USER'S GUIDE. Dickinson, R. P. Jr., Fritsch, F. N.; Hausman, R. F. Jr.; Sincovec, R. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Sep 1973. Contract W-7405-eng-48. 46p. Dep. NTIS $4.50.

EISPACK is a collection of subroutines, written in ANSI Standard Fortran, designed to compute the eigenvalues and eigenvectors for a variety of matrix problems. These codes, which will be periodically updated, form a complete eigensystem package, are representative of the state of the art in speed and accuracy, and have been thoroughly tested and certified. This report is intended to simplify the task of determining which of the routines are to be used for solving the particular problem at hand. (auth)

## Miscellaneous

**2341** (AP-116) CONTROL TECHNIQUES FOR BERYLLIUM AIR POLLUTANTS. (Environmental Protection Agency, Research Triangle Park, N. C. (USA)). Feb 1973. 73p. GPO.

Beryllium in almost all forms is known to have adverse effects upon human health. Concentrations as large as 0.01 microgram per cubic meter of air over a 30-day period have been determined to be safe for nonoccupational exposures. Beryllium extraction processes generate atmospheric emissions that include beryllium salts, acids, beryllium oxide, and other beryllium compounds in the form of dust, fume, or mist. Facilities engaged in processing beryllium-containing materials into finished products generate a more restricted range of emissions, including beryllium dust from machine shops, beryllium oxide dust from ceramic production, and beryllium-containing dust and fume from beryllium—copper foundry operations. Beryllium emissions can be controlled by the following classes of gas-cleaning equipment: prefilters, dry mechanical collectors, wet collectors, fabric filters, and high-efficiency particulate air filters (HEPA filters). The choice of specific control equipment is governed by process variables, effluent properties, and economics. In most cases, emission control costs, including capital investment, operating and maintenance costs, and capital charges, do not exceed 10 to 15% of the cost of manufacturing equipment. Beryllium-contaminated waste can be buried at controlled disposal sites unless it presents an explosion hazard. Beryllium propellant and other hazardous beryllium-contaminated wastes can be disposed of by controlled incineration or detonation employing appropriate emission-control devices. An appendix presents descriptions of geometrical configurations and performance characteristics of filters and presents examples of specific design parameters and operational features of filters in use in beryllium machine shops and foundries. (35 tables, 23 figures, 31 references) (auth)

**2342** (AP-117) CONTROL TECHNIQUES FOR ASBESTOS AIR POLLUTANTS. (Environmental Protection Agency, Research Triangle Park, N. C. (USA)). Feb. 1973. 105p. GPO.

This survey gives the background of the problem and outlines several methods of controlling the emissions. A rational methodology for estimating the installed and operating costs of the various types of control equipment is presented. (17 tables, 38 figures, 57 references). (LMT)

**2343** (AP-118) CONTROL TECHNIQUES FOR MERCURY EMISSIONS FROM EXTRACTION AND CHLOR-ALKALI PLANTS. (Environmental Protection Agency, Research Triangle Park, N. C. (USA)). Feb 1973. 75p. GPO.

The toxicity of mercury, combined with its high volatility, creates a potential health hazard. This publication deals with two sources of mercury emissions, the primary mercury processing industry and the mercury-cell chlor-alkali industry. An effort is made (1) to identify the process steps that may produce atmospheric mercury emissions, (2) to summarize the emission control techniques and low mercury emission processes used or applicable to these industries, and (3) to evaluate these techniques in terms of cost and effectiveness. (23 tables, 25 figures, 52 references) (LMT)

**2344** (BDX-613-783) INVESTIGATION OF KNITTED FABRICS. Taylor, R. F. (Bendix Corp., Kansas City, Mo. (USA)). Jan 1973. Contract AT(29-1)-613. 26p. Dep. NTIS $3.50.

Three knitted fabrics were evaluated as replacements for Fortisan-Dacron (MS2260444), a knitted fabric presently being used in skins on paper honeycomb and plastic parts. The three fabrics, knitted from rayon, polyester, and a 50:50 combination of rayon/polyester yarns, were impregnated with Epon 828/ Agent U resin to form laminates. (DLC)

**2345** (BNWL-1773) APPLICATION OF IDEAL REACTORS TO STUDIES IN ATMOSPHERIC CHEMISTRY. Hales, J. M.; Wilkes, J. O.; York, J. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Aug 1973. Contract AT(45-1)-1830. 37p. Dep. NTIS $4.00.

Mass-transfer effects and surface reactions may severely obscure the observation of homogeneous chemical reaction rates from experimental reactor data. Such problems are particularly pertinent to studies in the atmospheric sciences, owing to the tendency for increased surface-reaction interference at the low concentrations usually of interest. Criteria are presented for ideal behavior in three basic types of experimental reactors. Under conditions satisfying these criteria the effects of competing surface reactions can be accounted for quantitatively, allowing the true homogeneous effect to be observed. Data from tubular reactors can be analyzed accurately even under some nonideal conditions. The available solutions to tubular reactor models useful for this purpose were compiled and tabulated. (auth)

**2346** (CEA-CONF-2224) FIRST RESULTS FROM MEASUREMENT OF METALLIC POLLUTANTS IN THE BAY OF THE SEINE AND IN THE COTENTIN SECTOR. Gueguenlat, P.; Gandon, R. (Commissariat a l'Energie Atomique, la Hague (France)). 1972. 12p. (In French). (CONF-721146-4). Dep. NTIS (U. S. Sales Only) $3.00.

From 23rd meeting of the international commission for scientific exploitation of the Mediterranean Sea; Athens, Greece (3 Nov 1972).

**2347** (CEA-CONF-2233) TOXICITY OF ZINC FOR THE PINK SHRIMP PALAEMON SERRATUS PENNANT. Fraizier, A. (Commissariat a l'Energie Atomique, la Hague (France)). 1971. 21p. (In French). (CONF-721146-2). Dep. NTIS (U. S. Sales Only) $3.25.

From 23rd meeting of the international commission for scientific exploitation of the Mediterranean Sea; Athens, Greece (3 Nov 1972).

**2348** (CEA-CONF-2264) CONDUCT OF A STUDY ON MAINTENANCE: SOME RESULTS OBTAINED AT THE CEA. Adnot, S.; Blin, A.; Guyot, C. (Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). 1972. 9p. (In French). (CONF-730459-1). Dep. NTIS (U. S. Sales Only) $3.00.

**2349** (CEA-CONF-2292) RELIABILITY AND CERTAINTY OF FUNCTIONING IN INDUSTRIAL MEASUREMENT AND CONTROL. Furet, J. (Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). [nd]. 8p. (In French). (CONF-730459-2). Dep. NTIS (U. S. Sales Only) $3.00.

**2350** (CEA-CONF-229) APPLICATIONS OF ELECTRONICS IN THE FIELDS OF BIOLOGY AND MEDICINE. Delcroix, V. (Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires). 7 Dec 1972. 27p. (In French). (CONF-720229-1). Dep. NTIS (U. S. Sales Only) $3.50.

From seminar on French electronics; Madrid, Spain (21 Feb 1972).

**2351** (CEA-CONF-2337) MICROSCOPE STAGE WITH LARGE DISPLACEMENT WITH ASSOCIATED TRACKING. Blanchard, P. H. (Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires). [nd]. 14p. (In French). (CONF-720649-7). Dep. NTIS (U.S. Sales Only) $3.00.

From 14th committee of hot laboratories of EURATOM; Petten, Netherlands (8 Jun 1972).

**2352** (CEA-R-4420) THEORETICAL STUDY OF SHORT-RANGE AND LONG-RANGE ELECTRON–NUCLEUS COUPLING CONSTANTS IN HYDROCARBON RADICALS. Subra, R. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Nov 1973. 197p. (In French). Dep. NTIS (U. S. Sales Only) $12.00.

Thesis.

**2353** (CEA-R-4464) STUDY OF DEFECTS INDUCED BY PHOSPHORUS DIFFUSION IN SILICON. Correlations With Some Electrical Parameters of Devices. Mortini, P. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Oct 1973. 116p. (In French). Dep. NTIS (U.S. Sales Only) $8.00.

Thesis.

**2354** (CEA-R-4467) RECENT DEVELOPMENTS AND APPLICATIONS OF CHRONOMETRIC METHODS AND TECHNIQUES. Barrot, J. P.; Negrou, J. (CEA Centre d'Etudes Scientifiques et Techniques d'Aquitaine, 33–Le Barp (France)). Sep 1973. 23p. (In French). Dep. NTIS (U. S. Sales Only) $3.25.

Principles and specifications are given for: digital memory multichronometers, analyzing equipment working over short time intervals, high-frequency signal/digital analyzers, time interval generator. (DLC)

**2355** (CEA-R-4468) ANALYSIS OF FAST HIGH ENERGY ELECTRICAL SIGNALS. Barrot, J. P.; Jaussein, C. (CEA Centre d'Etudes Scientifiques et Techniques d'Aquitaine, 33, Le Barp (France)). Oct 1973. 25p. (In French). Dep. NTIS (U.S. Sales Only) $3.25.

**2356** (CEA-R-4476) CONFIRMATION OF THE EXISTENCE OF A LIQUID ZONE CREATED BY ELECTRON BOMBARDMENT. Deleuze, M. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92–Montrouge (France)). Sep 1973. 111p. (In French). Dep. NTIS (U. S. Sales Only) $7.75.

Thesis. Submitted to Lyon Univ. (France).

The existence of a liquid zone in metallic samples melted by electron bombardment was investigated. The preliminary research was oriented in two directions: an attempt to develop a nondestructive method enabling the zone to be located without altering the characteristics of the material (ultrasound was used); and an attempt to develop a more accurate destructive method for defining this zone (a centrifugation method was chosen). The thermal gradient existing in the material necessitates a knowledge of the effect of temperature on the propagation of ultrasound waves if the least temperature sensitive method is to be selected. A process was developed which is based on the discontinuity of the wave velocity at the solid–liquid phase change. This method was studied in detail and experimentally verified. The centrifugation method, which is very easily set up, provides excellent results for the contours of the molten zone. This method consists of removing the liquid metal from the sample so that the resulting cavity reveals the interface. The effects of the nature of the metal, the displacement of the sample, and the power of the bombarding electron beam on the form of the liquid zone are presented as examples for the case of certain pure metals. (auth)

**2357** (CONF-731104-1) NEUTRON MICROSCOPY OF SPIN DENSITY WAVE DOMAINS IN CHROMIUM. Davidson, J. B.; Werner, S. A.; Arrott, A. S. (Oak Ridge National Lab., Tenn. (USA); Ford Motor Co., Dearborn, Mich. (USA); Michigan Univ., Ann Arbor (USA); Simon Fraser Univ., Burnaby, British Columbia (Canada)). 1972. 5p. Dep. NTIS $3.00.

From 19th conference on magnetism and magnetic materials; Boston, Massachusetts, USA (13 Nov 1973).

The ORNL neutron camera is used to study structures in two Cr crystals. One crystal cut from an arc melted ingot showed two large domains that differ in the direction of the wave vector of the transverse linear spin density wave. The spatial variation of the mean polarization direction was analyzed for one of these domains and found to vary continuously across the crystal. Presumably the mean direction follows the local strain field. The other crystal grown from vapor, and presumably rather less influenced by strain effects, shows that the two components of the polarization coexist over most of the specimen in regions small compared to the resolution of the experiment, ~0.5 mm. (auth)

**2358** (COO-1140-207) SUBLIMATION THERMODYNAMICS AND KINETICS OF CUPROUS CHLORIDE. Part I. Vacuum Balance-Torsion Experiments. Part II. Mass Spectrometer Experiments. Peterson, D. E. (Kansas Univ., Lawrence (USA). Dept. of Chemistry). Oct 1972. Contract AT(11-1)-1140. 485p. Dep. NTIS $26.25.

Thesis.

Results of a thermodynamic and kinetic study of the sublimation of cuprous chloride are presented in two parts. The first part relates to research performed with the vacuum balance-torsion apparatus. Total vapor pressures, vapor compositions, and heats and entropies of sublimation determined for the sublimation of zinc metal and cuprous chloride are presented. The second part relates to the mass spectrometric measurements conducted on the sublimation of cuprous chloride. The partial pressures and heat and entropy of sublimation determined for each vapor species are given in this part. The same mechanism for the sublimation reaction of CuCl is proposed in each part, and a theoretical interpretation of the kinetics based on absolute reaction rate theory is given at the end of the second part. (auth)

**2359** (COO-1222-59) APPLICATIONS OF FOURIER TRANSFORM TECHNIQUES TO STERIC-EXCLUSION CHROMATOGRAPHY. Maldacker, T. A.; Davis, J. E.; Rogers, L. B. (Purdue Univ., Lafayette, Ind. Dept. of Chemistry). 1973. Contract AT(11-1)-1222. 28p. Dep. NTIS $3.50.

Correction for peak broadening was made using the peak for non-retained species. Signal-to-noise enhancement and data reduction were also examined. (auth)

**2360** (COO-1562-20) CANAVANINE DEATH AND THE MECHANISM OF DNA REPLICATION IN E. COLI. Progress Report, August 30, 1972–August 30, 1973. Rogers, P. (Minnesota Univ., Minneapolis (USA). Dept. of Microbiology). Sep 1973. Contract AT(11-1)-1562. 8p. Dep. NTIS $3.00.

**2361** (COO-1599-71) PHOTORESPIRATION AND RELEASE OF ORGANIC CARBON IN SUBMERSED AQUATIC VASCULAR PLANTS. Hough, R. A. (Michigan State Univ., East Lansing (USA)). 1973. 129p. Dep. NTIS $8.50.

Thesis.

**2362** (COO-3085-26) CHEMICAL PROTOTYPE OF TUMORS IN RELATION TO THE COMPOSITIONS OF RAT TISSUES. Knox, W. E. (New England Deaconess Hospital, Boston, Mass. (USA). Cancer Research Inst.). 1972. Contract AT(11-1)-3085. 32p. Dep. NTIS $3.75.

**2363** (GEPP-110) DETERMINATION OF OPTIMUM CHARACTERISTICS OF PYROXYLIN AS A METALLIZE SLURRY VEHICLE. Gillespie, T. J. (General Electric Co., St. Petersburg, Fla. (USA). Neutron Devices Dept.). 5 Nov 1973. Contract AT(29-2)-656. 10p. Dep. NTIS $3.00.

**2364** (INP-820) SPECTROSCOPIC STUDY OF VIBRATIONS IN CRYSTALLINE COMPOUNDS $[Me(NH_3)_6]X_2$. Grzybek, T.; Janik, J. A.; Janik, J. M.; Kulczycki, A.; Pytasz, G.; Sciesinska, E.; Sciesinski, J. (Institute of Nuclear Physics, Krakow (Poland)). 1973. 28p. Dep. NTIS (U. S. Sales Only) $3.50.

Infrared and Raman spectra of $[Me(NH_3)_6]X_2$ crystals were measured for Me = Co, Ni and X = Cl, Br, I, $BF_4$, $ClO_4$, $PF_6$. (auth)

**2365** (INP-830) SYSTEM OF THE AUTOMATIC TEMPERATURE CONTROL FOR A SMALL RESISTANCE FURNACE. Soltys, J.; Rzany, H.; Makar, R. (Institute of Nuclear Physics, Krakow (Poland)). Apr 1973. 10p. (In Polish). Dep. NTIS (U. S. Sales Only) $3.00.

2366 (IPP-9/11) ION SCATTERING AND SURFACE ANALYSIS. Heiland, W. (Max-Planck-Institut fuer Plasmaphysik, Garching/Munich (F.R. Germany)). May 1973. 25p. Dep. NTIS (U. S. Sales Only) $3.25.

2367 (JINR-P4-7291) SPIN-PHONON INTERACTION IN THE HEISENBERG FERROMAGNET. Vukailovich, F. R. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1973. 22p. (In Russian). Dep. NTIS (U. S. Sales Only) $3.25.

2368 (JINR-P4-7384) GREEN FUNCTIONS FOR A CRYSTALLINE SYSTEM IN THE SELF-CONSISTENT FIELD APPROXIMATION. Sadovnikov, B. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1973. 22p. (In Russian). Dep. NTIS (U.S. Sales Only) $3.25.

The Green functions for a crystalline system derived in the self-consistent field approximation are shown to satisfy the N.N. Bogolyubov theorem concerning the singularities of "$1/q^2$" type. (auth)

2369 (JPRS-60244) NUCLEAR PUMPING IN MOLECULAR GAS LASERS. Andriyakhin, V. M.; Vasil'tsov, V. V.; Krasil'nikov, S. S.; Pis'mennyi, V. D. Translated from Zh. Eksp. Teor. Fiz.; 63: No. 5, 1635-1644(1972). 19p. NTIS.

An examination is given of the mechanism of the populating of vibrational levels of molecules by electrons produced during the ionization of a gas by the products of nuclear reactions or by a beam of charged particles. (auth)

2370 (LA-5240-MS) MCP CODE FLUORESCENCE-ROUTINE REVISION. Everett, C. J.; Cashwell, E. D. (Los Alamos Scientific Lab., N. Mex.). May 1973. Contract W-7405-eng-36. 12p. Dep NTIS $4.00.

A new method is described for treating fluorescence, which replaces the original subroutine of the Monte Carlo photon code (MCP), and eliminates its most undesirable features. The major changes include (a) elimination of the very inaccurate $1/E^3$ law for photoelectric cross section, (b) updating of relative intensities of K-fluorescence lines, (c) elimination of fluorescence from shells other than K and L, and (d) provision for secondary L-fluorescence. Except for the latter, the previous code is unchanged, as well as the storage format. However, the change in method is reflected in the new constants, which have been completely revised, and are included here in tabulated form. (auth)

2371 (LA-5368-C) NOTES AND COMMENTS ON THE ROUND TABLE CONFERENCE ON DETONATIONS, COLORADO SPRINGS, JUNE 20–21, 1972. Davis, W. C. (comp.). (Los Alamos Scientific Lab., N. Mex. (USA)). Sep 1973. Contract W-7405-eng-36. 13p. Dep. NTIS $4.00.

2372 (LA-5414-MS) BACK DIODE OSCILLATOR FOR OPERATION BELOW ONE DEGREE KELVIN. Lester, D. H. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1973. Contract W-7405-eng-36. 2p. Dep. NTIS $4.00.

A back diode oscillator has been successfully used for the past two years to measure liquid He II level changes of $2.5 \times 10^{-6}$ cm/Hz. Construction information and frequency variation with temperature and voltage are included. (auth)

2373 (LA-5418-PR) IDENTIFICATION AND PURIFICATION OF THE HOG CHOLERA VIRUS ANTIGENS. Semiannual Report, January 1-June 30, 1973. Bartlett, M. L. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1973. Contract W-7405-eng-36. 3p. Dep. NTIS $4.00.

2374 (LA-5419-PR) HOG CHOLERA CONJUGATE EVALUATION. Annual Report, July 1, 1972-June 30, 1973. Forslund, J. C.; Cram, L. S. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1973. Contract W-7405-eng-36. 4p. Dep. NTIS $4.00.

2375 (LA-5420-PR) SOLUBLE ANTIGEN/FLUORESCENT ANTIBODY TEST FOR DETECTION OF ANTIBODIES TO TRICHINELLA SPIRALIS AND HOG CHOLERA VIRUS IN HOG SERA. Semiannual Report, January 1-June 30, 1973. Clinard, E. H. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1973. Contract W-7405-eng-36. 4p. Dep. NTIS $4.00.

2376 (LA-5421-PR) RAPID DIFFERENTIAL DIAGNOSIS OF NEWCASTLE DISEASE VIRUS. Annual Report, July 1, 1972–June 30, 1973. Cram, L. S. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1973. Contract W-7405-eng-36. 6p. Dep. NTIS $4.00.

2377 (LBL–1817) MEMORY SWITCHING EFFECTS IN As–Te–I CHALCOGENIDE GLASS. Jecmen, R. M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jul 1973. Contract W-7405-eng-48. 42p. Dep. NTIS $4.25.

Thesis.

The mechanism of switching an $As_{0.53}Te_{0.43}I_{0.04}$ glass from the memory to the high-resistance state and the effect of cycled switching on the chemical composition and electrical properties of the glass were studied. (DLC)

2378 (LBL-2043) ACTIVE INSOLUBILIZATION OF BIOLOGICAL COMPOUNDS. Rainey, P. M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1973. Contract W-7405-eng-48. 185p. Dep. NTIS $11.25.

Thesis.

2379 (LBL-2172) KINETICS AND INTERMEDIATES IN PHOTOSYNTHETIC OXYGEN EVOLUTION. Babcock, G. T. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1973. Contract W-7405-eng-48. 174p. Dep. NTIS $10.75.

Thesis.

2380 (MHSMP-73-21) DETONATION VELOCITY AND PRESSURE OF TETRYL PELLETS FROM TWO BATCHES. Warren, T. W. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.). Jul 1973. Contract DA-11-173-AMC-487(A). 11p. Dep. NTIS $4.00.

For Sandia Labs., Albuquerque, NM.

2381 (MLM-2090(OP)) BIODEGRADABILITY OF EXPLOSIVES. Lonadier, F. D.; Hedley, W. H.; Haws, L. D. (Mound Lab., Miamisburg, Ohio (USA)). [nd]. Contract AT-33-1-GEN-33. 11p. (CONF-730939-2). Dep. NTIS $3.00.

From 15th annual explosives safety seminar; San Francisco, California, USA (18 Sep 1973).

A literature survey was conducted. Initial experimental results on the biological degradation of PETN and on PETN analysis in batch-activated sludge reactors are reported. (DLC)

2382 (NBL-267, pp 56-66) PREPARATION OF TEST MATERIALS FOR AN INTERLABORATORY CALIFORNIUM-252 ACTIVATION ANALYSIS EVALUATION PROGRAM. Trahey, N. M.; Scarborough, J. M.; Bodnar, L. Z. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

To evaluate the general applicability of $^{252}$C as a neutron source for activation analysis, an interlaboratory program was designed by Savannah River Operations involving the analysis of two materials: a 2N nitric acid solution; and a 70% silica, 20% iron oxide, 10% calcium carbonate mixture, both containing 13 elements at various levels. Details of the preparation and characterization of these test materials, carried out by NBL, are described. (auth)

2383 (NBL-267, pp 67-69) ATOMIC ABSORPTION SPECTROPHOTOMETRIC DETERMINATION OF MERCURY IN TEST MATERIALS FOR THE CALIFORNIUM-252 EVALUATION PROGRAM. Graff, R. L. Sep 1973.

Annual progress report for the period July 1972 through June 1973.

Difficulty in the atomic absorption spectrophotometric determination of mercury in the test materials for the $^{252}$Cf evaluation program was traced to the presence of mercury(I) in the solutions for analysis. (auth)

2384 (ORNL-4867) MOLECULAR ANATOMY (MAN) PROGRAM. Semiannual Progress Report, September 1, 1972-February 28, 1973. Contract W-7405-eng-26. 246p. Dep. NTIS $14.50.

Separate abstracts were prepared for five sections of this report. (CH)

*For abstracts of individual papers see: 849 and 2385–2388.*

2385 (ORNL-4867, pp 1-20) CANCER. Oct 1973.

In Molecular Anatomy (MAN) Program. Semiannual Progress Report, September 1, 1972-February 28, 1973.

Techniques for isolating and purifying viruses that may be related to neoplasms are discussed. Many tumors were found to possess antigens which cross-react with those present in embryo or fetus and this fact was exploited by characterizing the immune responses of the host to a developing tumor and by preparing antigens and antibodies required for determining cancer status of tumor-bearing animals and the antitumor activity of circulating lymphocytes during tumor development and after surgery, radiation, immunological, or chemical treatment. Progress is reported: the isolation of cell-free soluble antigens from hamster fetal cells and virus-induced tumors of hamsters; the response of female hamsters and mice to fetal and tumor-associated antigens in vivo and in vitro, the prevention of mouse cancer by fetal immunization; in utero sensitization to fetal antigen; and the characterization of fetal antigens. (CH)

**2386** (ORNL-4867, pp 21-60) INFECTIOUS DISEASES. Oct 1973.

In Molecular Anatomy (MAN) Program. Semiannual Progress Report, September 1, 1972-February 28, 1973.

Methods used to identify viruses and parvovirus-like particles isolated from patients with various acute infectious nonbacterial diseases are described. The methods included the use of an immune electron microscope, density gradient separation, enzymatic analysis, serological assays, complement fixation, and radioimmunoassay techniques. Methods used in the preparation of a purified, stable, inactivated trivalent parainfluenza vaccine suitable for clinical trials in human volunteers are also described. (CH)

**2387** (ORNL-4867, pp 61-161) CLINICAL LABORATORY SCIENCES. Oct 1973.

In Molecular Anatomy (MAN) Program. Semiannual Progress Report, September 1, 1972-February 28, 1973.

Progress is reported in the development of automated high-resolution analytical systems for the separation and analysis of many of the molecular constituents in body fluids for clinical diagnosis. Fast analytical systems for the rapid analysis of large numbers of samples of body fluids using colorimetric and fluorometric assays for individual molecular constituents are also reported. (CH)

**2388** (ORNL)4867, pp 181-226) ASSOCIATED RESEARCH AND DEVELOPMENT. Oct 1973.

In Molecular Anatomy (MAN) Program. Semiannual Progress Report, September 1, 1972-February 28, 1973.

Methods used for the isolation of proteins characteristic of neoplasms are described. Antigen-antibody reactions on porous glass beads, enzyme assays in isolated cells, the design of centrifugal blood cell separators, and the refinement of techniques for quantitative immunofluorescence and high-resolution microscopy are also discussed. (CH)

**2389** (ORNL-TIRC-73-19) TOXICITY OF PALLADIUM, PLATINUM, AND THEIR COMPOUNDS. An Annotated Bibliography. Gerstner, H. (Toxicology Information Response Center, Oak Ridge, Tenn. (USA)). Jun 1973. 23p. Dep. NTIS $6.00.

**2390** (ORNL-TM-4290) CHLORINATION EFFECTS ON ORGANIC CONSTITUENTS IN EFFLUENTS FROM DOMESTIC SANITARY SEWAGE TREATMENT PLANTS. Jolley, R. L. (Oak Ridge National Lab., Tenn. (USA)). Oct 1973. Contract W-7405-eng-26. 369p. Dep. NTIS $20.50.

Thesis. Submitted to Univ. of Tennessee, Knoxville.

The effects of chlorination on effluents from the primary and secondary stages of domestic sanitary sewage treatment plants were determined by a method which coupled chlorination by $^{36}$Cl radioactive tracer with separation by high-resolution anion-exchange chromatography using sensitive radioactive tracer monitoring. Effluents were chlorinated with $^{36}$Cl-tagged chlorine under experimental conditions approximating those used at sewage treatment plants which were: chlorine dosage, 2.4 to 6.0 mg/liter; combined chlorine residual (as determined by the orthotolidine method), 1 to 2 mg/liter; temperature, 25°C; reaction time, 15 to 240 min. The chlorination yield, the portion of the chlorine dose associated with chlorine-containing stable organic compounds at the end of the chlorination reaction period, was approximately 1.0% for secondary effluents which had been chlorinated with 3.2 mg/liter chlorine to a chloride residual of 1 mg/liter for chlorination contact times of 15 to 45 min. The chlorination yield was approximately constant with respect to chlorine dosage (in the range studied) but increased with increasing reaction time. Chlorination yields were approximately the same for both primary and secondary effluents. Essentially the same effects were obtained by chlorination with either chlorine gas or hypochlorite solution. Based on the chlorination yields obtained in this research, it is roughly estimated that approximately 1,000 tons of chlorine in the form of stable chlorine-containing organic compounds are discharged annually from sewage treatment plants to the nation's waterways. In addition to the 17 chlorine-containing compounds that were separated from chlorinated secondary effluents, identified and quantified at the 0.5 to 4.3 $\mu$g/l level, 32 stable organic constituents were identified and 23 of these were quantified at 2- to 190-$\mu$g/liter levels in the effluents from domestic sanitary primary sewage treatment plants. Nine stable organic constituents were identified, and eight of these were quantified at 5- to 90-$\mu$g/liter levels in the effluents from domestic sanitary secondary sewage treatment plants. (52 tables, 29 figures, 367 references) (JGB)

**2391** (SC-DR-720647) STUDY OF LEAD FRAME PLATING VARIABLES. Johnson, D. R.; Hatcher, R. L. (Sandia Labs., Albuquerque, N. Mex. (USA)). Oct 1973. Contract AT(29-1)-789. 66p. Dep. NTIS $5.50.

A four-phase investigation was conducted of lead frame electroplating variables and their contribution to thermocompression bond quality in hybrid microcircuits: gold plating hardness and purity; nickel plating thickness; gold plating thickness; and combined variable proof test. (DLC)

**2392** (SLA-73-152) METHOD FOR MEASURING UNLOADING PATHS IN PARTIALLY COMPACTED STRAIN-RATE INSENSITIVE POROUS MATERIALS. Butcher, B. M.; Kent, L. A.; Lee, L. M. (Sandia Labs., Albuquerque, N. Mex. (USA)). Oct 1973. Contract AT(29-1)-789. 38p. Dep. NTIS $4.00.

An experimental method is described for measuring the unloading paths of strain-rate insensitive porous materials. The dynamic wave propagation condition of one-dimensional strain was approximated for these measurements by confining the samples in a hardened steel die. Unloading stress-volume paths were determined from sound-velocity measurements on the partially compacted samples at various stresses applied in the direction of wave propagation. Experimental results are presented for 2.16 g/m$^3$ porous 2024 aluminum, 6.77 g/cm$^3$ porous copper, and 1.73 g/cm$^3$ CVD carbon felt. (auth)

**2393** (SLA-73-635) NONLINEAR VISCOELASTIC EQUATION OF STATE FOR USE IN STRESS PROPAGATION CALCULATIONS. Lawrence, R. J. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1973. Contract AT(29-1)-789. 53p. Dep. NTIS $4.75.

**2394** (SLA-73-793) STUDIES OF Cr-Au THIN FILMS USED IN HYBRID MICROCIRCUITS. Kenna, B. T. (ed.). (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1973. Contract AT(29-1)-789. 33p. Dep. NTIS $3.75.

The capabilities of analytical techniques applied to the Cr-Au problem are described in terms of their applicability to the characterization of these and other films. The results and conclusions associated with this hybrid microcircuitry (HMC) system are then described. (auth)

**2395** (SLA-73-805) PRELIMINARY PHOTOLITHOGRAPHIC PROCEDURES FOR HYBRID SUBSTRATES WITH CONDUCTIVE VIAS. Hampy, R. E.; Wright, R. E. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1973. Contract AT(29-1)-789. 27p. Dep. NTIS $3.50.

A description is given of several photolithographic procedures which were developed to provide conductive feed-throughs or "vias" in hybrid microcircuits on alumina substrates in order to provide an electrical connection(s) between the front and back metallized conductor layers. (DLC)

**2396** (SLA-73-806) DEVELOPMENT OF PRODUCTION DEFINITION AND ASSOCIATED PROBLEMS OF THE MC2305 HYBRID CIRCUITS, JUNE 1969-DECEMBER 1971. Bushmire, D. W. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1973. Contract AT(29-1)-789. 25p. Dep. NTIS $3.25.

Sandia procurement experience with the MC2305 thin-film hybrid microcircuits is described. The MC2305 radar is a part of the MK3 arming, firing, and fusing system. These circuits use tantalum nitride as resistor material and aluminum as conductor material. The applique parts are chip-on-channel semiconductor devices and barium-titanate capacitors held down with epoxy. The interconnect system includes three-mil and one-mil aluminum wires with ultrasonic bonding. The discrete devices (capacitors, transistors and diodes) were procured from outside vendors by Collins Radio and Assembled on the thin-film substrate at Collins Radio. Specifications for the discrete devices and the completed hybrid circuit were originated at Sandia Laboratories. (auth)

**2397** (SLA-73-885) PLANT MAINTENANCE: CORRECTIVE MAINTENANCE HISTORY COMPUTER PROGRAM. DeVargas, J.; Smailer, A. D. (Sandia Labs., Albuquerque, N. Mex. (USA)). Oct 1973. Contract AT(29-1)-789. 26p. Dep. NTIS $3.00.

**2398** (SLA-73-905) EFFICIENCY OF FLASHLAMP EXCITED LASERS. Gusinow, M. A. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1973. Contract AT(29-1)-789. 10p. Dep. NTIS $3.00.

Assuming flashlamps to radiate as blackbodies, the fractional number of photons within a given absorption band is calculated along with the blackbody temperature required to optimize that fraction. (auth)

**2399** (SLA-73-911) EFFECT OF CRACK LENGTH AND BOND STRENGTH ON THE DELAMINATION PROCESS IN BORSIC-AL COMPOSITES. Hoover, W. R.; Allred, R. E. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1973. Contract AT(29-1)-789. 21p. Dep. NTIS $3.25.

The effect of crack length and fiber-matrix bond strength on the delamination process in unidirectional Borsic-Al composites has been examined using Single-Edge-Notch specimens. The transverse tensile strength, $\sigma_T$, was used as an indirect measure of the fiber-matrix bond strength, which was altered through variations in hot pressing during composite fabrication. In composites with weak fiber-matrix bonds ($\sigma_T$ = 3.2 ksi), the net-section stress at delamination, $\sigma_D$, was observed to decrease with increasing crack length. Variations in crack length did not significantly alter the basic fracture mechanism in which the delamination process led to notch insensitivity. Increases in the fiber-matrix bond strength ($\sigma_T$ increased from 3.2 ksi to 13.2 ksi) caused a marked increase in $\sigma_D$ but did not change the general delamination process. Through the use of cross-plied composites, the transverse strength was raised to 16.6 ksi and delamination was suppressed. This led to notch-sensitive fracture behavior and a substantial decrease in the fracture toughness compared with the composites which delaminated prior to failure. (auth)

**2400** (SLA-73-5191) GAS ANALYSIS DURING THE CHEMICAL VAPOR DEPOSITION OF CARBON. Lieberman, M. L.; Noles, G. T. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1973. 14p. (CONF-731017-3). Dep. NTIS $3.00.

From fourth international conference on chemical deposition vapor; Boston, Massachusetts, USA (7 Oct 1973).

Gas chromatography was used to study gas-phase pyrolysis reactions in carbon CVD studies. Results support a carbon CVD model presented previously. (9 figures, 12 references) (DLC)

**2401** (SLA-73-5414) INITIATION OF ELECTRON AVALANCHES ON AN ALUMINA INSULATOR BY AN ELECTRON BEAM. Brainard, J. P.; Jensen, D. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1972. 16p. (CONF-731026-1). Dep. NTIS $3.00.

From conference on electrical insulation and dielectric phenomena; Varennes Quebec, Canada (29 Oct 1973).

There is a delay time between the electron bombardment and the avalanche, which is a function of the electron beam intensity and the dV/dt of the applied voltage pulse. (DLC)

**2402** (SLA-73-5517) HYDROGEN EVOLUTION FROM ADHESIVES. DeLollis, N. J. (Sandia Labs., Albuquerque, N. Mex. (USA)). May 1973. 13p. (CONF-731019-1). Dep. NTIS $3.00.

From ASTM committee D-14 meeting; Denver, Colorado, USA (17 Oct 1973).

Aluminum is present in Sandia systems in the form of aluminum powder filler for adhesives and in aluminum alloy components. Both react with water to produce hydrogen. Platinized charcoal is shown to be an effective "getter" to remove hydrogen from a closed environment. (auth)

**2403** (SLL-73-231) VALVE INFORMATION PROGRAM. Tallerico, L. N.; DeCarli, C. J. (Sandia Labs., Livermore, Calif. (USA)). Oct 1968. Contract AT(29-1)-789. 126p. Dep. NTIS $8.50.

Supersedes SCL-DR-68-19.

The objectives of the program were to study the current explosive valve design, to determine techniques for measuring valve performance parameters, and to develop mathematical models for explosive valves and small explosive systems. (auth)

**2404** (UCID-16271) FUNCTION FOR REDUCTION OF THIN ABSORBER TPM DATA. Richards, L. M. (California Univ., Livermore. Lawrence Livermore Lab.). 10 May 1973. Contract W-7405-eng-48. 16p. Dep. NTIS $3.00.

Various diagnostic experiments involve measuring a pulse of energy deposited in a matrix of absorbing discs (TPM) whose temperature is measured with thermocouples connected in series. The desired information is $\Delta T$, the change in temperature caused by the absorbed energy. For a range of applications the absorbers are thin pieces of metal whose thermal diffusion time, $a^2/D$ (a = thickness, D = thermal diffusion constant, $k/\rho C_p$) is less than one millisecond, but much longer than the pulse. The usual electronics involves monitoring the signal for several tens of milliseconds after the pulse. During this time the chief phenomenon occurring is a cooling of the absorbers by conduction into the insulating, backing material. A solution to this conduction problem gives $T(t)/T_0$, i.e., the temperature as a function of time divided by the initial temperature caused by the pulse $\Delta T = T_0 - T(\infty)$. A solution is given for a simplified diffusion problem, a list of the assumptions which must be made to apply it to the real problem and some examples of such applications. (MOW)

**2405** (UCID-16342) PROPOSAL FOR A DIRECT NUMERICAL CONTROL SYSTEM. Eckard, R. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 24 Jul 1973. Contract W-7405-eng-48. 19p. Dep. NTIS $4.00.

This report describes a Direct Numerical Control (DNC) System proposed for use in the LLL Mechanical Shops. The DNC system includes a small digital computer that will provide the capability to store, manipulate, and distribute parts programs to the various machine tool stations. The system will also provide editing capabilities for parts program development and optimization. Diagnostic routines will be included to provide preventive maintenance. Logging of machine "on" time can be instituted to provide data for improved scheduling and machine tool usage. (auth)

**2406** (UCID-16353) APPLICATIONS OF PULSED LASER-INDUCED STRESS WAVES. Calder, C. A.; Wilcox, W. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 27 Sep 1973. Contract W-7405-eng-48. 27p. Dep. NTIS $3.50.

Very short duration stress waves generated by rapid energy deposition from a Q-switched ruby laser were used both to evaluate material properties by the Reynolds method and as a signal source for flaw detection. (DLC)

**2407** (UCID-16358) OPERATIONAL EXPERIENCE WITH THE MULTIPASS 16-DISC LONG PATH LASER SYSTEM. Shearer, J. W.; Swain, J. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 28 Sep 1973. Contract W-7405-eng-48. 13p. Dep. NTIS $3.00.

A brief summary is given of the operational and maintenance requirements for the Livermore "long path" laser system—the first short pulse neodymium ($\lambda$ = 1.06 $\mu$m) glass disc laser system. It is being issued at this time because the system is presently scheduled to be shut down at the end of the calendar year 1973. If the hardware is then put on the surplus equipment list, it would be useful for the future owner to have such information. (auth)

**2408** (UCRL-51448) TRANSIENT AND STEADY-STATE WATER VAPOR PERMEATION THROUGH POLYMER FILMS. Hubbell, W. H. Jr. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Sep 1973. Contract W-7405-eng-48. 24p. Dep. NTIS $3.25.

Thesis.

Water vapor transport properties were determined over a temperature range of 20 to 55°C for the polymers Kapton H, Parylene C, and Mylar A. (DLC)

**2409** (UR-3490-368) CHARACTERISTICS OF CALCIUM TRANSPORT IN ISOLATED BONE CELLS. Dziak, R. (Rochester Univ., N. Y. (USA)). 1973. 100p. Dep. NTIS $7.00.

Thesis.

**2410** (US-IBP-73-2(Vol. 3) (No. 2)) ABSTRACTS: US-INTERNATIONAL BIOLOGICAL PROGRAM ECOSYSTEM ANALYSIS STUDIES. Ferguson, N. (ed.). (Oak Ridge National Lab., Tenn. (USA)). Sep 1973. Contract W-7405-eng-26. 84p. Dep. NTIS $6.25.

**2411** (Y-DA-5130) LASER FUSION MIRROR MACHINING. Williams, R. L.; Warmbrod, W. M. (Oak Ridge Y-12 Plant, Tenn. (USA)). 1972. Contract W-7405-eng-26. 28p. (CONF-730930-4). Dep. NTIS $3.50.

From electro-optical systems design conference; New York, New York, USA (18 Sep 1973).

The concept of microinch machining is discussed in terms of surface finish, geometric accuracy, and dimensional accuracy. The requirements of the ultraprecision machine tools used to achieve microinch tolerances and finishes are discussed, including spindle and slide accuracies, vibration reduction, precise temperature control, and dynamic balancing techniques. In addition, the advantages of the single-crystal diamond cutting tools used on these machines are presented. Past and present microinch machining capabilities at Y-12 are discussed, along with specific applications and experimental work performed. (auth)

**2412** GENERAL CIRCULATION OF THE TROPICAL ATMOSPHERE AND INTERACTIONS WITH EXTRATROPICAL LATITUDES. Volume 1. Newell, R. E.; Kidson, J. W.; Vincent, D. G.; Boer, G. J. Cambridge, MA; Massachusetts Institute of Technology Press (1972). 270p. (COO-2195-1). $15.50.

# CORPORATE INDEX

In the Corporate Index, technical report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

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*INIS: Authority List for Corporate Entries and Report Number Prefixes* (IAEA-INIS-6) is used in the standardization of corporate entries. IAEA-INIS-6 is available from INIS Section, International Atomic Energy Agency, P. O. Box 590, A-1011, Vienna, Austria and from the U. S. Atomic Energy Commission, Technical Information Center, P. O. Box 62, Oak Ridge, TN 37830.

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## D

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## E

**Eberline Instrument Corp., Santa Fe, N.Mex. (USA)**
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  - ARMS: radiological survey of the area surrounding the Nine Mile Point Nuclear Station, Scriba, New York. Date of survey: 20 September 1969. Technical report No. L-1106, 29:372 (EGG--1183-1592)
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- **Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)**
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## G

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- **General Electric Co., St. Petersburg, Fla. (USA). Neutron Devices Dept.**
  - Determination of optimum characteristics of pyroxylin as a metallize slurry vehicle, 29:2363 (GEPP--110)
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  - Critical Experiments and Cooperative Evaluations Program seventh quarterly report, April--June 1973, 29:2092 (GEAP--13771-7)
  - LMFBR alternate shutdown system development and testing. Fifth quarterly report, January--March 1973, 29:2101 (GEAP--13824-5)
  - LMFBR heat exchanger materials development program second quarterly progress report, September--November 1972, 29:948 (GEAP--13919-2)
  - Performance of mixed-oxide fuel rods irradiated to 13 atom percent burnup in EBR-II, 29:2009 (GEAP--13538)
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  - Southwest Experimental Fast Oxide Reactor. Quarterly environmental and facility radiation survey, June 1--August 31, 1973, 29:2137 (DOCKET-50231--137)
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- **Gulf General Atomic Co., San Diego, Calif. (USA)**
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## H

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**Houston Univ., Tex. (USA)**

- Dynamics of the DPF as determined from an analysis of laser scattering spectra, 29:1911
- Effects of dilute alloying on the elastic constants and superconducting energy gap in thallium, 29:1552

**Howard Univ., Washington, D.C. (USA). Dept. of Biochemistry**

- Chemical effects of ionizing radiations on the individual amino acids within intact and pure protein molecules. Annual progress report for the period beginning February 1, 1973, 29:513 (ORO--4183-16)

## I

**Idaho Nuclear Corp., Idaho Falls (USA)**

- Preliminary review of ICPP solids storage hazards, 29:1049 (ICP--1038)

**IIT Research Inst., Chicago, Ill. (USA)**

- Scavenging study of snow and ice crystals. Quarterly report, 1 April 1973--30 June 1973, 29:384 (IITRI-C--6105-24)
- Scavenging study of snow and ice crystals. Final technical report for the period 1 April 1972--31 March 1973, 29:383 (IITRI-C--6105-23)

**Illinois Univ., Urbana (USA)**

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**Indiana Univ. Foundation, Bloomington (USA)**

- Technical progress report of the Indiana University Spark Chamber Group, December 1, 1972--November 30, 1973, 29:1380 (COO--2009-60)

**Institute of Nuclear Physics, Krakow (Poland)**

- Dispersive sum rules and their applications in strong interactions theory, 29:1459 (INP--833)
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**Institute of Nuclear Research, Warsaw (Poland)**

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- Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Zentralabteilung Strahlenschutz
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  - Identification and purification of the hog cholera virus antigens. Semiannual report, January 1--June 30, 1973, 29:2373 (LA--5418-PR)
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**Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Physics**
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**Northwestern Univ., Evanston, Ill. (USA)**
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**Nuclear Services Corp., Campbell, Calif. (USA)**
- Kewaunee Nuclear Power Plant. PIO-02-03, analysis report: maximum energy of disc impact main steam check and isolation valves, 29:2280 (DOCKET-50305--107)

## O

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- Fast reactor experimental shielding monthly progress report for July 1973. 189a No. 10028, activity No. HN 04 01 01 1, 25:2012 (ORNL-TM--4364)
- Fission-product afterheat: a review of experiments pertinent to the thermal-neutron fission of $^{235}$U, 29:2093 (ORNL-TM--4197)
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Because of problems involved in the mechanical preparation of this index, all accent marks are omitted. The following changes in spelling have been introduced to reduce some of the confusion which might result from omitting the accents:

| | | |
|---|---|---|
| Germanic | ä appears as | ae |
| Germanic | ö | oe |
| Germanic | ü | ue |
| Scandinavian | ϕ | oe |

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# SUBJECT INDEX

The subject indexing of literature announced in *Nuclear Science Abstracts* is based on the use of descriptors* selected from a controlled thesaurus of terms. Subject descriptors and qualifiers (subheadings) are selected and presented in the following format:

SUBJECT DESCRIPTOR/QUALIFIER
Title (supplementary information), volume number:abstract number

For example:

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AGE ESTIMATION/FISSION TRACKS
  Kinetics of fission track disappearance in muscovite
    mica, 28:18240 (CONF-700705--(Vol.2))
AGE ESTIMATION/RESEARCH PROGRAMS
  Report on the work of the Institute of Nuclear Sciences.
    Progress report 20, July--December 1972 (Lower Hutt,
    New Zealand), 28:19867 (INS--593)
AGR TYPE REACTORS/FUEL ELEMENTS
  Technique for preparing electron-microscopy specimens
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MILLSTONE-3 REACTOR/REACTOR SAFETY
  Preliminary safety analysis report, Amendment 7;
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  Preliminary safety analysis report, Amendment 6;
    responses to AEC questions, 28:20491 (DOCKET-50423--20)
MILNE PROBLEM/NUMERICAL SOLUTION
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MILNE PROBLEM/WAVE PROPAGATION
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ZIRCON/NOZZLES
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ZIRCONIUM/ACTIVATION ANALYSIS
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The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

All index entries cite *NSA* volume and abstract numbers; the volume number precedes the colon and the abstract number follows it. Report numbers, where applicable, are included in parentheses after the abstract number. Published literature (journal article or book) can be identified by the absence of a report number.

The descriptors selected for use as subject terms are generally the names of specific materials, things, and processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in the original literature, rather than words that may appear in the article. Within the available thesaurus terms, indexers select what seems the most probable or logical place to look for typical information. However, users of the index should consider synonymous or closely related terms.

Information is indexed for the greatest use to the greatest number of users. This requires that a topic be indexed using subject entries that most specifically describe it and not ordinarily its ultimate use. Only the most specific subject entries are made for a given topic. For example, information on the Yankee-Rowe nuclear power plant is indexed using the subject descriptor ROWE YANKEE REACTOR but not NUCLEAR POWER PLANTS, POWER REACTORS, or PWR TYPE REACTORS. For the broader term and narrower term relationships of descriptors, refer to IAEA-INIS-13.

Specific and general examples can be given as guidance, but for complete understanding, a study should be made of subject entry patterns used to index specific information.

The standard indexing patterns used for some specific subject areas follow.

## REACTOR TECHNOLOGY

Subject terms for reactors are of three types: (1) specific reactor names, e.g., BEPO REACTOR, INDIAN POINT-1 REACTOR; (2) reactors having a common physics or engineering characteristic, e.g., FBR TYPE REACTORS, SODIUM COOLED REACTORS; and (3) reactors having a common purpose, as POWER REACTORS, RESEARCH REACTORS.

Information on a specific reactor is indexed using the subject descriptor for that reactor name. Information on classes or types of reactors is indexed using subject descriptors for all applicable reactor types. For example, an article on a sodium-cooled fast breeder power reactor, without a specific name, is indexed using FBR TYPE REACTORS, SODIUM COOLED REACTORS, and POWER REACTORS. Where applicable, subject descriptors that name reactor components may be used, e.g., FUEL ELEMENTS, even though the term is also used as a qualifier of a general reactor term. Indexing is provided for materials used in reactor components when the information is peculiar to the material. For example, if the article deals with corrosion of stainless steel in a sodium cooled reactor, STAINLESS STEELS would be chosen as a pertinent subject descriptor.

In general, qualifiers of reactor subject descriptors are of two types. One type expresses reactor characteristics, e.g., REACTIVITY, and the other indicates components, e.g., CONTROL ELEMENTS.

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*The descriptors used for indexing are selected from the thesaurus of the IAEA International Nuclear Information System (INIS). TIC is a major contributor to thesaurus concepts and maintenance. The thesaurus, IAEA-INIS-13, is available from the USAEC Technical Information Center, P. O. Box 62, Oak Ridge, TN 37830.

## PARTICLE INTERACTIONS OF HIGH ENERGY PHYSICS

Information on particle-particle events is indexed using subject descriptors that name the particles involved. These subject descriptors have the form PION-NUCLEON INTERACTIONS, MESON-BARYON INTERACTIONS, etc. Such terms are constructed so that the lighter particle appears first in the combination.

A citation on cross sections of pion-neutron interactions would be found by referring to the entry PION-NEUTRON INTERACTIONS/CROSS SECTIONS. This is a dual entry of descriptors corresponding to the main heading-subheading combination of a more conventional index. Each citation under this entry will consist of the title of the article or the title with additional informative words.

Subject terms are also provided for specific models and theories. For example, OCTET MODEL, STRONG-COUPLING MODEL, SYMMETRY GROUPS, etc.

## CHEMISTRY

Subject descriptors in chemistry are generally names of elements, isotopes, and compounds. Qualifiers designate properties, processes, and reactions as specifically as possible.

Compounds on which there are significant quantities of information in the literature of nuclear science and technology are indexed by using specific descriptors following the nomenclature of the literature, e.g., METHYL IODIDE, TBP, 2-METHYLPROPANE, URANIUM DIOXIDE, etc.

Compounds occurring less frequently are indexed using more general terms or combinations of terms. In such cases all of the descriptors used to describe the compounds may be selected as subject terms or only the ones of main importance. In these cases the complete compound is indicated in either the title or title augmentation. For example, ethyl bromide is indexed using the subject descriptor BROMINATED ALIPHATIC HYDROCARBONS, uranyl acetates is included as URANYL COMPOUNDS, and lithium fluoroberyllates appears as LITHIUM FLUORIDES and BERYLLIUM FLUORIDES.

Terms for chemical reactions, processes, and properties are not used as subject descriptors in indexing information on specific materials. Such terms are included for publications such as books, reviews, or general treatment of the subject.

## LIFE SCIENCES

Information in this area is indexed using subject descriptors for specific animals, plants, microorganisms, biochemicals, biological systems and processes, cells, organs, radiation effects, and substances modifying radiation effects. DNA, BARLEY, HELA CELLS, BEAGLES, PATIENTS, BACILLUS SUBTILIS, LACTATE DEHYDROGENASE, and CHROMOSOMAL ABERRATIONS are examples of specific subject descriptors. While most descriptors are common names, genus and species names are sometimes used, e.g., DROSOPHILA. If the specific name of an organism or biochemical is not used, the name of a higher category is used instead. For example, clams are indexed using the subject descriptor MOLLUSCS, Anopheles pharoensis using MOSQUITOS, and glutamine oxalacetic acid transaminase using TRANSFERASES. Title augmentation is used to more completely identify the organisms or substances.

Subject descriptors naming incident radiation are used only if dose, RBE, or other radiation quality studies are made.

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| | 29-623 | |
| CONF-710851- | | (International conference on mechanical behavior of materials, Kyoto, Japan, 15-20 Aug 1971) |
| SP | 29-913 | Kyoto; Society of Materials Science (1972). |
| CONF-710921- | | (International symposium on dynamics of ionized gases, Tokyo, Japan, 13-18 Sep 1971) |
| | 29-1832 | New York; John Wiley and Sons, Inc. (1973). |
| CONF-710942- | | (4. international seminar on heat and mass transfer in liquid metals, Trojir, Yugoslavia, 6-11 Sep 1971) |
| | 29-273 | Elmsford, NY; Pergamon Press, Inc. (1973). $54.00 |
| CONF-710988- | | (Marine radioecology symposium, Hamburg, F.R. Germany, 20-24 Sep 1971) |
| | 29-405 | Paris; Organization for Economic Co-operation and Development (1972). $4.50 |
| CONF-720229- | | (Seminar on French electronics, Madrid, Spain, 21-25 Feb 1972) |
| 1 | 29-2350 | See CEA-CONF-2295 |
| CONF-720481- | | (Conference on parameters of the vascular system relating to radiation response, London, UK, 12-14 Apr 1972) |
| | 29-701 | London; Medical College of St. Bartholomew's Hospital (1972). |
| CONF-720516- | | (Digital Equipment Computer Userd Society spring symposium, Boston, Massachusetts, USA, 11-13 May 1972) |
| | 29-440 | Maynard, MA; Digital Equipment Computer Users Society (1972). |
| CONF-720607- | | (10. annual American Nuclear Society conference, Las Vegas, Nevada, USA, 18-22 Jun 1972) |
| 37 | 29-1998 | See GULF-GA-A-12167 |
| CONF-720640- | | (3. international conference on many-body reactions, Zakopane, Poland, 20-24 Jun 1972) |
| 3 | 29-1063 | See COO-1112-174 |
| CONF-720649- | | (14. committee of hot laboratories of EURATOM, Petten, Netherlands, 8-9 Jun 1972) |
| 7 | 29-2351 | See CEA-CONF-2337 |
| CONF-720952- | | (Symposium on collective methods of acceleration, Dubna, USSR, 27-30 Sep 1972) |
| 6 | 29-1065 | See KFK-tr-428 |
| 7 | 29-1064 | See KFK-tr-426 |
| CONF-721097- | | (CREST specialist meeting on emergency core cooling for light water reactors, Garching/Munich, F.R. Germany, 18-20 Oct 1972) |
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| (P2) | 29-2070 | See MRR-115(Vol.2) |
| CONF-721146- | | (23. meeting of the International Commission for Scientific Exploitation of the Mediterranean Sea, Athens, Greece, 3-11 Nov 1972) |
| 2 | 29-2347 | See CEA-CONF-2233 |
| 4 | 29-2346 | See CEA-CONF-2224 |
| CONF-730128- | | (Chemist - meteorologist workshop - 1973 meeting, Ft. Lauderdale, Florida, USA, 15-19 Jan 1973) |
| (Absts.) | 29-388 | See WASH-1217-73 |
| CONF-730315- | | (3. international symposium on toroidal plasma confinement, Garching, F.R. Germany, 26-30 Mar 1973) |
| 15 | 29-1796 | See GULF-GA-A-12512 |
| CONF-730459- | | (International exhibition and congress mesucora 73 and 64 physics exhibition meeting, Paris, France, 11-18 Apr 1973) |
| 1 | 29-2348 | See CEA-CONF-2264 |
| 2 | 29-2349 | See CEA-CONF-2292 |
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| 12 | 29-697 | See COO-3017-9 |
| 13 | 29-452 | See BNL-18221 |
| CONF-730650- | | (American Institute of Biological Sciences meeting, Amherst, Massachusetts, USA, 21 Jun 1973) |
| 2 | 29-351 | See BNL-18173 |
| CONF-730829- | | (13. international congress of genetics, Berkeley, California, USA, 20-29 Aug 1973) |
| 2 | 29-531 | See UCSF-10-P-2-X-1 |
| CONF-730836- | | (3. workshop on laser interaction and related plasma phenomena, Troy, New York, USA, 13-17 Aug 1973) |
| 3 | 29-1864 | See LA-UR-73-1394 |
| CONF-730907- | | (3. international congress of the International Radiation Protection Association meeting, Washington, District of Columbia, USA, 9-14 Sep 1973) |
| 14 | 29-374 | See LA-UR-73-1291 |
| CONF-730912- | | (International conference on physical metallurgy of reactor fuel elements, Berkeley, England, UK, 2-7 Sep 1973) |
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| 2 | 29-87 | See DP-MS-73-42 |
| CONF-731012- | | (13. international congress of radiology, Madrid, Spain, 15-20 Oct 1973) |
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| 3 | 29-2400 | See SLA-73-5191 |
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| 1 | 29-489 | See SLA-73-5731 |
| CONF-731026- | (Conference on electrical insulation and dielectric phenomena, Quebec, Canada, 29-31 Oct 1973) | |
| 1 | 29-2401 | See SLA-73-5414 |
| CONF-731101- | (Joint meeting of the American Nuclear Society and the Atomic Industrial Forum and Nuclear Energy Exhibition, San Francisco, California, USA, 11-16 Nov 1973) | |
| 2 | 29-1053 | See DP-MS-73-52 |
| 6 | 29-1903 | See BNWL-SA-4773 |
| 7 | 29-323 | See HEDL-SA-584 |
| 8 | 29-495 | See LA-UR-73-884 |
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| 16 | 29-385 | See LA-UR-73-954 |
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| 1 | 29-269 | See LA-UR-73-1067 |
| CONF-731110- | (Symposium on the physical behavior of radioactive containment in the atmosphere, Vienna, Austria, 12-16 Nov 1973) | |
| 1 | 29-381 | See BNWL-SA-4723 |
| 3 | 29-376 | See RLO-2225-T-18-6 |
| CONF-6509100- | (9. meeting of the USAEC Reactor Decontamination Information Exchange Group, Washington, District of Columbia, USA, 1-2 Sep 1965) | |
| 1 | 29-2050 | See BNWL-CC-173 |
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| 271 | 29-2171 | Dep. NTIS, $3.00 |
| 273 | 29-2172 | Dep. NTIS, $3.75 |
| 278 | 29-2173 | Dep. NTIS, $3.00 |
| DOCKET-50255- | (Palisades Nuclear Plant, Non-AEC) | |
| 173 | 29-2174 | Dep. NTIS, $4.00 |
| 191 | 29-2175 | Dep. NTIS, $3.00 |
| 192 | 29-2176 | Dep. NTIS, $3.00 |
| 194 | 29-2177 | Dep. NTIS, $3.00 |
| 195 | 29-2178 | Dep. NTIS, $3.00 |
| 203 | 29-2179 | Dep. NTIS, $3.00 |
| DOCKET-50259- | (Browns Ferry Nuclear Power Station, Unit 1, See also DOCKET-50260 and DOCKET-50296, Non-AEC) | |
| 133 | 29-2180 | Dep. NTIS, $3.00 |
| 134 | 29-2181 | Dep. NTIS, $3.00 |
| 138 | 29-2182 | Dep. NTIS, $3.00 |
| 139 | 29-2183 | Dep. NTIS, $3.00 |
| 140 | 29-2184 | Dep. NTIS, $3.00 |
| 141 | 29-2185 | Dep. NTIS, $3.00 |
| 143 | 29-2186 | Dep. NTIS, $3.00 |
| 146 | 29-2187 | Dep. NTIS, $3.00 |
| 154 | 29-2188 | Dep. NTIS, $3.00 |
| 155 | 29-2189 | Dep. NTIS, $3.00 |
| 156 | 29-2190 | Dep. NTIS, $3.00 |
| 157 | 29-2191 | Dep. NTIS, $3.00 |
| 158 | 29-2192 | Dep. NTIS, $3.00 |
| 162 | 29-2193 | Dep. NTIS, $3.00 |
| 165 | 29-2194 | Dep. NTIS, $3.00 |
| 167 | 29-2195 | Dep. NTIS, $3.00 |
| 168 | 29-2196 | Dep. NTIS, $3.00 |
| 170 | 29-2197 | Dep. NTIS, $3.00 |
| 171 | 29-2198 | Dep. NTIS, $3.00 |
| 174 | 29-2199 | Dep. NTIS, $3.00 |
| 175 | 29-2200 | Dep. NTIS, $3.00 |
| 176 | 29-2201 | Dep. NTIS, $3.00 |
| 179 | 29-2202 | Dep. NTIS, $3.00 |
| 180 | 29-2203 | Dep. NTIS, $3.75 |
| 182 | 29-2204 | Dep. NTIS, $3.75 |
| 191 | 29-2205 | Dep. NTIS, $3.00 |
| 207 | 29-2206 | Dep. NTIS, $3.00 |
| 208 | 29-2207 | Dep. NTIS, $3.00 |
| 209 | 29-2208 | Dep. NTIS, $3.00 |
| DOCKET-50260- | (Browns Ferry Nuclear Power Station, Unit 2, See also DOCKET-50259 and DOCKET-50296, Non-AEC) | |
| 114 | 29-2202 | See DOCKET-50259-179 |
| 115 | 29-2203 | See DOCKET-50259-180 |
| 117 | 29-2204 | See DOCKET-50259-182 |
| 122 | 29-2209 | Dep. NTIS, $3.00 |
| DOCKET-50261- | (H. B. Robinson Plant, Unit 2, Non-AEC) | |
| 251 | 29-2210 | Dep. NTIS, $3.00 |
| 255 | 29-2211 | Dep. NTIS, $4.75 |
| 269 | 29-2212 | Dep. NTIS, $3.00 |
| 270 | 29-2213 | Dep. NTIS, $3.00 |
| 272 | 29-2234 | Dep. NTIS, $3.00 |
| DOCKET-50263- | (Monticello Nuclear Generating Plant, Unit 1, Non-AEC) | |
| 259 | 29-2214 | Dep. NTIS, $3.00 |
| DOCKET-50265- | (Quad-Cities Station, Unit 2, See also DOCKET-50254, Non-AEC) | |
| 241 | 29-2162 | See DOCKET-50254-248 |
| 244 | 29-2163 | See DOCKET-50254-251 |
| 245 | 29-2164 | See DOCKET-50254-253 |
| 246 | 29-2165 | See DOCKET-50254-254 |
| 249 | 29-2215 | Dep. NTIS, $3.00 |
| 250 | 29-2166 | See DOCKET-50254-258 |
| 253 | 29-2169 | See DOCKET-50254-264 |
| 257 | 29-2171 | See DOCKET-50254-271 |
| 258 | 29-2170 | See DOCKET-50254-268 |
| 259 | 29-2168 | See DOCKET-50254-263 |
| 261 | 29-2172 | See DOCKET-50254-273 |
| 266 | 29-2216 | Dep. NTIS, $3.00 |
| DOCKET-50267- | (Fort St. Vrain Nuclear Generating Station, Non-AEC) | |
| 78 | 29-2217 | Dep. NTIS, $5.75 |
| 79 | 29-2218 | Dep. NTIS, $3.00 |
| 81 | 29-2219 | Dep. NTIS, $3.00 |
| 82 | 29-2220 | Dep. NTIS, $3.00 |
| DOCKET-50269- | (Oconee Nuclear Station, Unit 1, See also DOCKET-50270 and DOCKET-50287, Non-AEC) | |
| 159 | 29-2221 | Dep. NTIS, $3.00 |
| 162 | 29-2222 | Dep. NTIS, $3.00 |
| DOCKET-50270- | (Oconee Nuclear Station, Unit 2, See also DOCKET-269 and DOCKET-50287, Non-AEC) | |
| 117 | 29-2223 | Dep. NTIS, $5.25 |
| DOCKET-50271- | (Vermont Yankee Nuclear Power Station, Non-AEC) | |
| 207 | 29-2224 | Dep. NTIS, $3.00 |
| 208 | 29-2225 | Dep. NTIS, $3.00 |
| 227 | 29-2226 | Dep. NTIS, $3.00 |
| 228 | 29-2227 | Dep. NTIS, $3.00 |
| 230 | 29-2228 | Dep. NTIS, $3.00 |
| 238 | 29-2229 | Dep. NTIS, $3.00 |
| 239 | 29-2230 | Dep. NTIS, $3.00 |
| 245 | 29-2231 | Dep. NTIS, $4.00 |
| 341 | 29-2232 | Dep. NTIS, $3.00 |
| DOCKET-50277- | (Peach Bottom Atomic Power Station, Unit 2, See also DOCKET-50171 and DOCKET-50278, Non-AEC) | |
| 131 | 29-2233 | Dep. NTIS, $3.75 |
| DOCKET-50278- | (Peach Bottom Atomic Power Station, Unit 3, See also DOCKET-50171 and DOCKET-50277, Non-AEC) | |
| 104 | 29-2233 | See DOCKET-50277-131 |
| DOCKET-50280- | (Surry Power Station, Unit 1, See also DOCKET-50281, Non-AEC) | |
| 181 | 29-2235 | Dep. NTIS, $4.25 |
| 187 | 29-2236 | Dep. NTIS, $3.00 |
| DOCKET-50281- | (Surry Power Station, Unit 2, See also DOCKET-50280, Non-AEC) | |
| 136 | 29-2237 | Dep. NTIS, $3.00 |
| 150 | 29-2235 | See DOCKET-50280-181 |
| DOCKET-50282- | (Prairie Island Nuclear Generating Plant, Unit 1, See also DOCKET-50306, Non-AEC) | |
| 155 | 29-2238 | Dep. NTIS, $3.00 |
| 159 | 29-2239 | Dep. NTIS, $3.00 |
| 161 | 29-2240 | Dep. NTIS, $3.00 |
| 162 | 29-2241 | Dep. NTIS, $4.75 |
| 165 | 29-2242 | Dep. NTIS, $3.00 |
| 166 | 29-2243 | Dep. NTIS, $5.75 |
| DOCKET-50285- | (Fort Calhoun Station, Unit 1, Non-AEC) | |
| 128 | 29-2244 | Dep. NTIS, $3.00 |
| 129 | 29-2245 | Dep. NTIS, $3.00 |
| 131 | 29-2246 | Dep. NTIS, $3.00 |
| 134 | 29-2247 | Dep. NTIS, $3.00 |
| DOCKET-50286- | (Indian Point Station, Unit 3, See also DOCKET-50003 and DOCKET-50247, Non-AEC) | |
| 100 | 29-2248 | Dep. NTIS, $3.00 |
| 102 | 29-2249 | Dep. NTIS, $14.00 |
| 106 | 29-2250 | Dep. NTIS, $29.50 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| DOCKET-50293- | (Pilgrim Nuclear Power Station, Unit 1, Non-AEC) | |
| 161 | 29-2251 | Dep. NTIS, $3.00 |
| 164 | 29-2252 | Dep. NTIS, $3.00 |
| 165 | 29-2253 | Dep. NTIS, $3.00 |
| 167 | 29-2254 | Dep. NTIS, $3.00 |
| 175 | 29-2255 | Dep. NTIS, $3.00 |
| 182 | 29-2256 | Dep. NTIS, $3.00 |
| 185 | 29-2257 | Dep. NTIS, $3.00 |
| 186 | 29-2258 | Dep. NTIS, $3.00 |
| 187 | 29-2259 | Dep. NTIS, $3.00 |
| 188 | 29-2260 | Dep. NTIS, $3.00 |
| 190 | 29-2261 | Dep. NTIS, $3.50 |
| 191 | 29-2262 | Dep. NTIS, $3.00 |
| 192 | 29-2263 | Dep. NTIS, $3.00 |
| 193 | 29-2264 | Dep. NTIS, $3.00 |
| 196 | 29-2231 | See DOCKET-50271-245 |
| 197 | 29-2265 | Dep. NTIS, $3.00 |
| DOCKET-50295- | (Zion Nuclear Plant, Unit 1, See also DOCKET-50304, Non-AEC) | |
| 165 | 29-2266 | Dep. NTIS, $3.00 |
| 167 | 29-2267 | Dep. NTIS, $3.00 |
| 168 | 29-2268 | Dep. NTIS, $3.00 |
| 169 | 29-2269 | Dep. NTIS, $3.00 |
| 173 | 29-2270 | Dep. NTIS, $3.00 |
| 177 | 29-2271 | Dep. NTIS, $3.00 |
| 178 | 29-2272 | Dep. NTIS, $3.00 |
| 183 | 29-2273 | Dep. NTIS, $5.25 |
| 184 | 29-2274 | Dep. NTIS, $3.00 |
| 186 | 29-2275 | Dep. NTIS, $3.00 |
| 187 | 29-2276 | Dep. NTIS, $3.00 |
| DOCKET-50296- | (Browns Ferry Nuclear Power Station, Unit 3, See also DOCKET-50259 and DOCKET-50260, Non-AEC) | |
| 104 | 29-2202 | See DOCKET-50259-179 |
| 105 | 29-2203 | See DOCKET-50259-180 |
| 107 | 29-2204 | See DOCKET-50259-182 |
| 110 | 29-2209 | See DOCKET-50260-122 |
| DOCKET-50298- | (Cooper Nuclear Station, Non-AEC) | |
| 92 | 29-2277 | Dep. NTIS, $3.00 |
| DOCKET-50301- | (Point Beach Nuclear Plant, Unit 2, Non-AEC) | |
| 106 | 29-2278 | Dep. NTIS, $3.00 |
| DOCKET-50304- | (Zion Nuclear Plant, Unit 2, See also DOCKET-50295, Non-AEC) | |
| 116 | 29-2269 | See DOCKET-50295-169 |
| 126 | 29-2279 | Dep. NTIS, $4.00 |
| DOCKET-50305- | (Kewaunee Nuclear Power Plant, Non-AEC) | |
| 107 | 29-2280 | Dep. NTIS, $5.75 |
| 111 | 29-2281 | Dep. NTIS, $3.00 |
| 114 | 29-2282 | Dep. NTIS, $3.00 |
| DOCKET-50306- | (Prairie Island Nuclear Generating Plant, Unit 2, See also DOCKET-50282, Non-AEC) | |
| 133 | 29-2239 | See DOCKET-50282-159 |
| 135 | 29-2242 | See DOCKET-50282-165 |
| DOCKET-50309- | (Maine Yankee Atomic Power Plant, Non-AEC) | |
| 139 | 29-2283 | Dep. NTIS, $3.00 |
| 145 | 29-2284 | Dep. NTIS, $3.00 |
| DOCKET-50313- | (Arkansas Nuclear One, Unit 1, Non-AEC) | |
| 107 | 29-2285 | Dep. NTIS, $3.00 |
| DOCKET-50317- | (Calvert Cliffs Nuclear Power Plant, Unit 1, See also DOCKET-50318, Non-AEC) | |
| 129 | 29-2286 | Dep. NTIS, $3.00 |
| 130 | 29-2287 | Dep. NTIS, $3.00 |
| 134 | 29-2288 | Dep. NTIS, $3.00 |
| DOCKET-50318- | (Calvert Cliffs Nuclear Power Plant, Unit 2, See also DOCKET-50317, Non-AEC) | |
| 113 | 29-2286 | See DOCKET-50317-129 |
| 114 | 29-2287 | See DOCKET-50317-130 |
| 116 | 29-2288 | See DOCKET-50317-134 |
| DOCKET-50327- | (Sequoyah Nuclear Plant, Unit 1, See also DOCKET-50328, Non-AEC) | |
| 47 | 29-2184 | See DOCKET-50259-140 |
| 53 | 29-2289 | Dep. NTIS, $3.00 |
| 54 | 29-2290 | Dep. NTIS, $4.25 |
| DOCKET-50328- | (Sequoyah Nuclear Plant, Unit 2, See also DOCKET-50327, Non-AEC) | |
| 47 | 29-2289 | See DOCKET-50327-53 |
| 48 | 29-2290 | See DOCKET-50327-54 |
| DOCKET-50331- | (Duane Arnold Energy Center, Non-AEC) | |
| 115 | 29-2291 | Dep. NTIS, $3.00 |
| DOCKET-50336- | (Millstone Nuclear Power Station, Unit 2, Non-AEC) | |
| 78 | 29-2292 | Dep. NTIS, $7.00 |
| 81 | 29-2293 | Dep. NTIS, $3.00 |
| DOCKET-50338- | (North Anna Power Station, Unit 1, See also DOCKET-50339, Non-AEC) | |
| 93 | 29-2294 | Dep. NTIS, $5.75 |
| DOCKET-50339- | (North Anna Power Station, Unit 2, See also DOCKET-50338, Non-AEC) | |
| 90 | 29-2294 | See DOCKET-50338-93 |
| DOCKET-50341- | (Enrico Fermi Atomic Power Plant, Unit 2, See also DOCKET-50016, Non-AEC) | |
| 73 | 29-2295 | Dep. NTIS, $3.00 |
| DOCKET-50344- | (Trojan Nuclear Plant, Non-AEC) | |
| 78 | 29-2296 | Dep. NTIS, $5.50 |
| DOCKET-50358- | (Wm. H. Zimmer Nuclear Power Station, Unit 1, See also DOCKET-50359, Non-AEC) | |
| 51 | 29-2297 | Dep. NTIS, $11.50 |
| DOCKET-50367- | (Bailly Generating Station Nuclear 1, Non-AEC) | |
| 44 | 29-2298 | Dep. NTIS, $4.50 |
| DOCKET-50409- | (LaCrosse Boiling Water Reactor, AEC) | |
| 64 | 29-2299 | Dep. NTIS, $3.00 |
| 68 | 29-2300 | Dep. NTIS, $3.75 |
| DOCKET-50413- | (Catawba Nuclear Station, Unit 1, See also DOCKET-50414, Non-AEC) | |
| 51 | 29-2301 | Dep. NTIS, $14.75 |
| DOCKET-50414- | (Catawba Nuclear Station, Unit 2, See also DOCKET-50413, Non-AEC) | |
| 51 | 29-2301 | See DOCKET-50413-51 |
| DOCKET-50458- | (River Bend Station, Unit 1, See also DOCKET-50459, Non-AEC) | |
| 1 | 29-2302 | Dep. NTIS, $10.75 |
| DOCKET-50459- | (River Bend Station, Unit 2, See also DOCKET-50458, Non-AEC) | |
| 1 | 29-2302 | See DOCKET-50458-1 |
| DP-MS- | | |
| 73-32 | 29-359 | Dep. NTIS, $3.50 |
| 73-37 | 29-2091 | Dep. NTIS, $3.00 |
| 73-42 | 29-87 | Dep. NTIS, $3.25 |
| 73-47 | 29-2332 | Dep. NTIS, $3.00 |
| 73-52 | 29-1053 | Dep. NTIS, $3.00 |
| DPC- | | |
| 851-62 | 29-2300 | See DOCKET-50409-68 |
| EANDC(E)- | (Italy) | |
| 151(U) | 29-1720 | See EURFNR-1110 |
| EGG- | | |
| 1183-1581 | 29-367 | See ARMS-70.6.11 |
| 1183-1584 | 29-363 | See ARMS-68.6.5 |
| 1183-1585 | 29-366 | See ARMS-70.6.8 |
| 1183-1591 | 29-382 | Dep. NTIS, $3.25 |
| 1183-1592 | 29-372 | Dep. NTIS, $3.00 |
| 1183-1593 | 29-373 | Dep. NTIS, $3.00 |
| 1183-1596 | 29-368 | See ARMS-72.6.4 |
| EURFNR- | (European Atomic Energy Community) | |
| 1110 | 29-1720 | Dep. NTIS (US Sales Only), $7.75 |
| FEI- | (USSR) | |
| 366 | 29-1721 | Dep. NTIS (US Sales Only), $3.00 |
| FMI- | | |
| 1000-431 | 29-1093 | Dep. NTIS, $3.00 |
| FRNC-TH- | (France) | |
| 394 | 29-1600 | Dep. NTIS (US Sales Only), $6.50 |
| 398 | 29-1874 | Dep. NTIS (US Sales Only), $5.25 |
| GEAP- | (Misc.) | |
| 12418 | 29-914 | Dep. NTIS, $4.00 |
| 12444 | 29-2008 | Dep. NTIS, $4.00 |
| 13538 | 29-2009 | Dep. NTIS, $7.60 |
| 13771-7 | 29-2092 | Dep. NTIS, $5.45 |
| 13824-5 | 29-2101 | AT |
| 13919-2 | 29-948 | Dep. NTIS, $5.45 |
| 13971 | 29-2010 | AT |
| GEPP- | | |
| 110 | 29-2363 | Dep. NTIS, $3.00 |
| GULF-GA-A- | | |
| 12167 | 29-1998 | Dep. NTIS, $3.50 |
| 12512 | 29-1796 | Dep. NTIS, $3.00 |
| 12632 | 29-915 | Dep. NTIS, $3.00 |
| 12690 | 29-1904 | Dep. NTIS, $7.60 |
| HEDL-SA- | | |
| 569 | 29-2046 | Dep. NTIS, $3.00 |
| 584 | 29-323 | Dep. NTIS, $3.00 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| HEDL-TME- | | |
| 73-66 | 29-2011 | AT |
| HMI-B- | (F.R. Germany) | |
| 140 | 29-2333 | Dep. NTIS (US Sales Only), $4.50 |
| 141 | 29-2334 | Dep. NTIS (US Sales Only), $3.00 |
| HW- | | |
| 81030 | 29-231 | Dep. NTIS, $3.00 |
| IAE- | (USSR) | |
| 2222 | 29-1601 | Dep. NTIS (US Sales Only), $3.00 |
| IAEA-R- | (Internatinal Atomic Energy Agency) | |
| 731-F | 29-506 | INIS |
| ICP- | | |
| 1026 | 29-222 | Dep. NTIS, $4.00 |
| 1038 | 29-1049 | Dep. NTIS, $6.25 |
| IFVE-SEF- | (USSR) | |
| 72-116 | 29-1365 | Dep. NTIS (US Sales Only), $3.50 |
| IFVE-SPK- | (USSR) | |
| 72-33 | 29-474 | INIS |
| IFVE-STF- | (USSR) | |
| 72-110 | 29-1361 | Dep. NTIS (US Sales Only), $3.25 |
| 73-3 | 29-1395 | Dep. NTIS (US Sales Only), $3.50 |
| IFVE-STF/SEF- | (USSR) | |
| 72-115 | 29-1430 | Dep. NTIS (US Sales Only), $4.50 |
| IITRI-C- | | |
| 6105-23 | 29-383 | Dep. NTIS, $7.00 |
| 6105-24 | 29-384 | Dep. NTIS, $3.75 |
| INP- | (Poland) | |
| 820 | 29-2364 | Dep. NTIS (US Sales Only), $3.50 |
| 830 | 29-2365 | Dep. NTIS (US Sales Only), $3.00 |
| 833 | 29-1459 | Dep. NTIS (US Sales Only), $6.25 |
| 842 | 29-1369 | Dep. NTIS (US Sales Only), $3.00 |
| INR- | (Non-AEC) | |
| 1461 | 29-1602 | Dep. NTIS (US Sales Only), $3.75 |
| 1463 | 29-699 | Dep. NTIS (US Sales Only), $3.00 |
| 1466 | 29-1663 | Dep. NTIS (US Sales Only), $3.00 |
| IPP- | (Non-AEC) | |
| 9/10 | 29-494 | Dep. NTIS (US Sales Only), $3.75 |
| 9/11 | 29-2366 | Dep. NTIS (US Sales Only), $3.25 |
| IPP-IV- | (F.R. Germany) | |
| 53 | 29-234 | Dep. NTIS (US Sales Only), $7.00 |
| IS- | | |
| 3238 | 29-2335 | Dep. NTIS, $3.00 |
| ITEP- | (USSR) | |
| 844 | 29-1641 | INIS |
| ITJ- | (Poland) | |
| 17 | 29-1937 | Dep. NTIS (US Sales Only), $5.00 |
| 42 | 29-482 | Dep. NTIS (US Sales Only), $3.75 |
| JAB- | (Non-AEC) | |
| 99-92 | 29-340 | Dep. NTIS, $4.00 |
| JINR- | (USSR) | |
| P1-7309 | 29-475 | Dep. NTIS (US Sales Only), $3.00 |
| P4-6952 | 29-1797 | Dep. NTIS (US Sales Only), $3.00 |
| P4-7291 | 29-2367 | Dep. NTIS (US Sales Only), $3.25 |
| P4-7384 | 29-2368 | Dep. NTIS (US Sales Only), $3.25 |
| P6-7355 | 29-454 | Dep. NTIS (US Sales Only), $3.00 |
| P9-6951 | 29-1914 | Dep. NTIS (US Sales Only), $3.25 |
| P9-7239 | 29-1851 | Dep. NTIS (US Sales Only), $3.50 |
| P9-7357 | 29-1072 | Dep. NTIS (US Sales Only), $3.25 |
| P9-7412 | 29-1073 | Dep. NTIS (US Sales Only), $3.00 |
| P10-7302 | 29-455 | Dep. NTIS (US Sales Only), $3.25 |
| P10-7358 | 29-476 | Dep. NTIS (US Sales Only), $3.00 |
| P13-7171 | 29-477 | Dep. NTIS (US Sales Only), $3.00 |
| P13-7172 | 29-478 | Dep. NTIS (US Sales Only), $3.00 |
| P13-7176 | 29-1094 | Dep. NTIS (US Sales Only), $3.00 |
| P13-7206 | 29-479 | Dep. NTIS (US Sales Only), $3.00 |
| JPRS- | (Non-AEC) | |
| 60244 | 29-2369 | NTIS |
| JUL- | (F.R. Germany) | |
| 949-PC | 29-146 | Dep. NTIS (US Sales Only), $4.25 |
| 952-ST | 29-2327 | Dep. NTIS (US Sales Only), $10.75 |
| K-L- | | |
| 6328 | 29-1054 | Dep. NTIS, $3.00 |
| KFK- | (F.R. Germany) | |
| 1629 | 29-1720 | See EURFNR-1110 |
| 1725 | 29-1579 | Dep. NTIS (US Sales Only), $4.75 |
| 1736 | 29-916 | Dep. NTIS (US Sales Only), $8.75 |
| 1824 | 29-917 | Dep. NTIS (US Sales Only), $3.75 |
| 1839 | 29-918 | Dep. NTIS (US Sales Only), $4.75 |
| KFK-EXT- | (F.R. Germany) | |
| 3/73-1 | 29-1587 | Dep. NTIS (US Sales Only), $5.50 |
| 3/73-2 | 29-1710 | Dep. NTIS (US Sales Only), $5.25 |
| 6/73-1 | 29-919 | Dep. NTIS (US Sales Only), $3.75 |
| KFK-tr- | (F.R. Germany) | |
| 426 | 29-1064 | Dep. NTIS (US Sales Only), $3.00 |
| 428 | 29-1065 | Dep. NTIS (US Sales Only), $3.00 |
| KFTI- | | |
| 72-22 | 29-1588 | INIS |
| KHFTI- | (USSR) | |
| 73-2 | 29-2336 | Dep. NTIS (US Sales Only), $3.00 |
| LA- | | |
| 5240-MS | 29-2370 | Dep. NTIS, $4.00 |
| 5280 | 29-1342 | Dep. NTIS, $4.00 |
| 5332 | 29-1074 | Dep. NTIS, $4.00 |
| 5362-MS | 29-421 | Dep. NTIS, $4.00 |
| 5368-C | 29-2371 | Dep. NTIS, $4.00 |
| 5390-PR | 29-920 | Dep. NTIS, $4.00 |
| 5403-MS | 29-1906 | Dep. NTIS, $4.00 |
| 5404-MS | 29-1069 | Dep. NTIS, $4.00 |
| 5406-MS | 29-2310 | Dep. NTIS, $4.00 |
| 5411-MS | 29-1907 | Dep. NTIS, $4.00 |
| 5414-MS | 29-2372 | Dep. NTIS, $4.00 |
| 5418-PR | 29-2373 | Dep. NTIS, $4.00 |
| 5419-PR | 29-2374 | Dep. NTIS, $4.00 |
| 5420-PR | 29-2375 | Dep. NTIS, $4.00 |
| 5421-PR | 29-2376 | Dep. NTIS, $4.00 |
| 5423-MS | 29-249 | Dep. NTIS, $4.00 |
| LA-tr- | | |
| 73-44 | 29-1070 | Dep. NTIS, $3.00 |
| LA-UR- | | |
| 73-804 | 29-921 | Dep. NTIS, $3.00 |
| 73-884 | 29-495 | Dep. NTIS, $3.00 |
| 73-913 | 29-1055 | Dep. NTIS, $3.00 |
| 73-939 | 29-503 | Dep. NTIS, $3.00 |
| 73-954 | 29-385 | Dep. NTIS, $3.00 |
| 73-1067 | 29-269 | Dep. NTIS, $3.00 |
| 73-1291 | 29-374 | Dep. NTIS, $3.00 |
| 73-1389 | 29-632 | Dep. NTIS, $3.00 |
| 73-1394 | 29-1864 | Dep. NTIS, $3.25 |
| LBL- | | |
| 1617 | 29-2377 | Dep. NTIS, $4.25 |
| 2043 | 29-2378 | Dep. NTIS, $11.25 |
| 2064 | 29-480 | Dep. NTIS, $4.00 |
| 2172 | 29-2379 | Dep. NTIS, $10.75 |
| LF-tr- | | |
| 80 | 29-814 | Dep. NTIS, $3.00 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| LMEC-TDR- | | |
| 73-7 | 29-250 | AT |
| 73-8 | 29-251 | AT |
| 73-9 | 29-252 | AT |
| LNF/ADR- | (Italy) | |
| 2 | 29-1088 | Dep. NTIS (US Sales Only), $3.00 |
| LRP- | (Switzerland) | |
| 63/73 | 29-2311 | Dep. NTIS (US Sales Only), $5.50 |
| LURI- | (Sweden) | |
| 1972-9 | 29-403 | Dep. NTIS (US Sales Only), $4.50 |
| LYCEN- | (France) | |
| 7320 | 29-1075 | Dep. NTIS (US Sales Only), $3.00 |
| 7344 | 29-1696 | Dep. NTIS (US Sales Only), $3.00 |
| MHSMP- | | |
| 73-21 | 29-2380 | Dep. NTIS, $4.00 |
| MLM- | | |
| 2068 | 29-147 | Dep. NTIS, $5.45 |
| 2090(OP) | 29-2381 | Dep. NTIS, $3.00 |
| MRR- | (F.R. Germany) | |
| 115(Vol.1) | 29-2055 | |
| 115(Vol.2) | 29-2070 | |
| N- | (Misc.) | |
| 73-13376 | 29-1274 | NTIS |
| NASA-CR- | (Misc.) | |
| 121190 | 29-2052 | See ANCR-1120 |
| 121191 | 29-2051 | See ANCR-1118 |
| 130128 | 29-1274 | See N-73-13376 |
| NBL- | | |
| 267 | 29-4 | Dep. NTIS, $5.45 |
| NERC-LV- | | |
| 539-2(Suppl.) | 29-404 | Dep. NTIS, $4.00 |
| NIIAR-P- | (USSR) | |
| 159 | 29-1580 | INIS |
| NTS- | | |
| 249 | 29-427 | See USGS-474-173 |
| 252 | 29-428 | See USGS-474-177 |
| NVO- | | |
| 137 | 29-341 | Dep. NTIS, $3.25 |
| 294-6 | 29-375 | Dep. NTIS, $4.00 |
| ORAU- | | |
| 121 | 29-848 | Dep. NTIS, $7.60 |
| ORNL- | | |
| 4867 | 29-2384 | Dep. NTIS, $14.50 |
| 4915 | 29-511 | Dep. NTIS, $7.60 |
| ORNL-EIS- | | |
| 73-52(Vol.1) (No.10) | 29-2312 | Dep. NTIS, $3.25 |
| ORNL-TIRC- | | |
| 73-19 | 29-2389 | Dep. NTIS, $6.00 |
| ORNL-TM- | | |
| 1251(Rev.) | 29-456 | Dep. NTIS, $3.25 |
| 4094 | 29-922 | Dep. NTIS, $4.75 |
| 4197 | 29-2093 | Dep. NTIS, $7.00 |
| 4233 | 29-1050 | Dep. NTIS, $4.00 |
| 4250 | 29-966 | AT |
| 4287 | 29-429 | Dep. NTIS, $3.25 |
| 4290 | 29-2390 | Dep. NTIS, $20.50 |
| 4306 | 29-1993 | Dep. NTIS, $6.00 |
| 4308 | 29-1027 | Dep. NTIS, $3.75 |
| 4323 | 29-633 | Dep. NTIS, $10.75 |
| 4331 | 29-2085 | AT |
| 4342 | 29-1908 | Dep. NTIS, $3.25 |
| 4353 | 29-1909 | Dep. NTIS, $4.00 |
| 4363 | 29-1798 | Dep. NTIS, $3.00 |
| 4364 | 29-2012 | AT |
| 4368 | 29-1938 | Dep. NTIS, $9.50 |
| ORNL-tr- | | |
| 2727 | 29-1910 | Dep. NTIS, $3.25 |
| 2728 | 29-203 | Dep. NTIS, $3.00 |
| ORO- | | |
| 3329-9 | 29-767 | Dep. NTIS, $3.00 |
| 4183-16 | 29-513 | Dep. NTIS, $3.00 |
| 4328-1 | 29-396 | Dep. NTIS, $11.75 |
| 4328-2 | 29-435 | Dep. NTIS, $15.25 |
| PATENTS- | (Belgium: Service de la Propriete Industrielle et Commerciale, 24-24, rue DeMot, B1040 Brussels, Belgium, 7.5 BF per page or as microcards at 10 BF per microcard, plus postage) | |
| 798,823 | 29-469 | |
| PATENTS- | (Canadian: Commissioner of Patents, Ottawa, Canada, KIA OEI; $1.00 per copy) | |
| 909,402 | 29-1048 | |
| 918,311 | 29-507 | |
| PATENTS- | (French: Service d'Edition et de Vente des Publications Officielles, 39 rue de la Convention, Paris 15, France, 2.50 F per copy, plus 1.80 F postage for 1 copy) | |
| 2,138,328 | 29-2003 | |
| 2,140,277 | 29-1057 | |
| 2,143,600 | 29-893 | |
| 2,147,769 | 29-592 | |
| 2,147,777 | 29-2017 | |
| 2,147,784 | 29-1061 | |
| PATENTS- | (German: Deutsches Patentamt, Dienststelle Berlin, Gitschiner Str. 97-103, 1000 Berlin 61, F.R. Germany, DM 3.- per copy, plus postage) | |
| 1,613,117 | 29-2313 | |
| 1,642,487 | 29-224 | |
| 1,671,026 | 29-937 | |
| 1,758,036 | 29-960 | |
| 1,758,299 | 29-939 | |
| 1,758,953 | 29-961 | |
| 1,805,114 | 29-467 | |
| 1,813,582 | 29-940 | |
| 1,901,784 | 29-938 | |
| 1,903,009 | 29-962 | |
| 1,906,355 | 29-1353 | |
| 1,913,556 | 29-466 | |
| 1,916,292 | 29-959 | |
| 1,917,689 | 29-1056 | |
| 1,921,666 | 29-984 | |
| 1,923,229 | 29-504 | |
| 1,926,377 | 29-598 | |
| 1,937,577 | 29-166 | |
| 1,938,386 | 29-473 | |
| PATENTS- | (UK: Comptroller-General, The Patent Office (Sale Branch), St. Mary Cray, Orpington, Kent, BR 53rd, UK, 0.25 pounds per copy) | |
| 1,323,475 | 29-2005 | |
| 1,323,530 | 29-24 | |
| 1,323,881 | 29-2001 | |
| 1,324,192 | 29-2100 | |
| PATENTS- | (UR: The abstracts are obtained from Otkrytiya, Izobreteniya, Promyshlennye Obraztye Znaki in which abstracts only are published., ur) | |
| 246,702 | 29-505 | |
| PATENTS- | (US: Commissioner of Patents, Washington, D.C. 20231, USA, $.50 per copy) | |
| 3,748,615 | 29-1575 | |
| 3,757,396 | 29-2099 | |
| 3,758,777 | 29-499 | |
| 3,758,781 | 29-463 | |
| PNE-G- | | |
| 84 | 29-341 | See NVO-137 |
| PR-CMa- | (Canada) | |
| 24 | 29-1 | See AECL-4509 |
| PRDI- | | |
| 73-1 | 29-2303 | TIC Free |
| PRNC- | | |
| 164 | 29-1939 | Dep. NTIS, $6.00 |
| 170 | 29-514 | Dep. NTIS, $4.50 |
| 171 | 29-386 | Dep. NTIS, $4.50 |
| PTB-ND- | (F.R. Germany) | |
| 4 | 29-457 | Dep. NTIS (US Sales Only), $3.75 |
| RAI- | | |
| 73-9 | 29-2304 | TIC, $1.25 |
| RDT-M- | | |
| 16-1-T(10-73) | 29-223 | RSD |
| RISO- | (Denmark) | |
| 290 | 29-1799 | Dep. NTIS (US Sales Only), $3.00 |
| RISO-M- | (Denmark) | |
| 1632 | 29-497 | Dep. NTIS (US Sales Only), $4.00 |
| RL- | | |
| 73-76 | 29-1399 | See COO-3265-10 |
| 73-82 | 29-1473 | Dep. NTIS (US Sales Only), |

| Report No. | Abstract No. | Availability |
|---|---|---|
| | | $3.00 |
| 73-101 | 29-1400 | Dep. NTIS (US Sales Only), $3.00 |
| RLO- | | |
| 2225-T-18-6 | 29-376 | Dep. NTIS, $3.50 |
| RT/BIO- | (Italy) | |
| (72)28 | 29-379 | Ateneo Parmense, Sez. 2. Acta Natur., 7: No. 1, 1-12(1971) |
| RT/PROT- | (Italy) | |
| (73)3 | 29-25 | Chim. Ind. (Milan), 54: No. 9, 805-808(1972) |
| SC-DR- | | |
| 720647 | 29-2391 | Dep. NTIS, $5.50 |
| SGAE- | (Austria) | |
| 2157 | 29-1582 | Dep. NTIS (US Sales Only), $7.50 |
| SLA- | | |
| 73-140 | 29-2047 | Dep. NTIS, $5.50 |
| 73-152 | 29-2392 | Dep. NTIS, $4.00 |
| 73-500 | 29-1865 | Dep. NTIS, $3.25 |
| 73-635 | 29-2393 | Dep. NTIS, $4.75 |
| 73-643 | 29-235 | Dep. NTIS, $3.50 |
| 73-708 | 29-488 | Dep. NTIS, $3.75 |
| 73-793 | 29-2394 | Dep. NTIS, $3.75 |
| 73-805 | 29-2395 | Dep. NTIS, $3.50 |
| 73-806 | 29-2396 | Dep. NTIS, $3.25 |
| 73-837 | 29-1095 | Dep. NTIS, $3.75 |
| 73-866 | 29-2337 | Dep. NTIS, $4.75 |
| 73-885 | 29-2397 | Dep. NTIS, $3.00 |
| 73-905 | 29-2398 | Dep. NTIS, $3.00 |
| 73-911 | 29-2399 | Dep. NTIS, $3.25 |
| 73-5080 | 29-958 | Dep. NTIS, $3.00 |
| 73-5191 | 29-2400 | Dep. NTIS, $3.00 |
| 73-5414 | 29-2401 | Dep. NTIS, $3.00 |
| 73-5468 | 29-2338 | Dep. NTIS, $3.00 |
| 73-5517 | 29-2402 | Dep. NTIS, $3.00 |
| 73-5731 | 29-489 | Dep. NTIS, $3.00 |
| SLAC- | | |
| 165 | 29-1066 | Dep. NTIS, $5.45 |
| SLL- | | |
| 73-231 | 29-2403 | Dep. NTIS, $8.50 |
| 73-275 | 29-2339 | Dep. NTIS, $3.00 |
| SM- | (Misc.) | |
| 181/6 | 29-381 | See BNWL-SA-4723 |
| 181/34 | 29-376 | See RLO-2225-T-18-6 |
| TID- | | |
| 3336 | 29-253 | Dep. NTIS, $7.60 |
| UCID- | | |
| 16271 | 29-2404 | Dep. NTIS, $3.00 |
| 16342 | 29-2405 | Dep. NTIS, $4.00 |
| 16353 | 29-2406 | Dep. NTIS, $3.50 |
| 16357 | 29-1800 | Dep. NTIS, $3.00 |
| 16358 | 29-2407 | Dep. NTIS, $3.00 |
| 30047(Rev.1) | 29-2328 | Dep. NTIS, $22.25 |
| 30077 | 29-2340 | Dep. NTIS, $4.50 |
| UCRL- | | |
| 51417 | 29-342 | Dep. NTIS, $5.75 |
| 51422 | 29-90 | Dep. NTIS, $4.00 |
| 51427 | 29-1722 | Dep. NTIS, $4.00 |
| 51440 | 29-387 | Dep. NTIS, $4.00 |
| 51447 | 29-343 | Dep. NTIS, $4.00 |
| 51448 | 29-2408 | Dep. NTIS, $3.25 |
| 51453 | 29-344 | Dep. NTIS, $5.45 |
| UCRL-Trans- | | |
| 1503 | 29-1076 | Dep. NTIS, $3.50 |
| 1504 | 29-1077 | Dep. NTIS, $3.75 |
| 1505 | 29-1078 | Dep. NTIS, $4.00 |
| UCSF- | | |
| 10-P-2-143 | 29-682 | J. Invest. Dermatol., 60: No. 6, 374-380(1973) |
| 10-P-2-169 | 29-668 | Cancer Res., 33: 362-369(Feb 1973) |
| 10-P-2-X-1 | 29-531 | Dep. NTIS, $3.00 |
| UJF- | (Czechoslovakia) | |
| 2987-F | 29-1079 | Dep. NTIS (US Sales Only), $3.00 |
| UM-HE- | (Non-AEC) | |
| 72-24 | 29-1367 | See COO-1112-170 |
| UR- | | |
| 3490-368 | 29-2409 | Dep. NTIS, $7.00 |
| US-IBP- | | |
| 73-2(Vol.3) (No.2) | 29-2410 | Dep. NTIS, $6.25 |
| USGS- | | |
| 474-137 | 29-426 | Dep. NTIS, $4.00 |
| 474-173 | 29-427 | Dep. NTIS, $4.00 |
| 474-177 | 29-428 | Dep. NTIS, $4.00 |
| WARD- | | |
| 2171-26 | 29-2048 | AT |
| WARD-NA- | | |
| 3045-6 | 29-949 | AT |
| WASH- | | |
| 1217-73 | 29-388 | GPO, $0.45 |
| WCAP- | (Misc.) | |
| 7921 | 29-2086 | |
| 8110(Suppl.2) | 29-2305 | |
| 8110(Suppl.3) | 29-2306 | |
| 8153 | 29-2149 | See DOCKET-50244-208 |
| Y-DA- | | |
| 5130 | 29-2411 | Dep. NTIS, $3.50 |
| Y-DR- | | |
| 111 | 29-1723 | Dep. NTIS, $4.00 |

# Appendix 1

# SCOPE AND SECTION ARRANGEMENT OF NUCLEAR SCIENCE ABSTRACTS

## Introduction

This publication defines the subject scope and arrangement of the literature in *Nuclear Science Abstracts (NSA)*. Broadly stated, the subject scope of *NSA* includes all of nuclear science and technology defined as follows:

> **Nuclear science is the study of the production, properties, and phenomena of atomic nuclei, subatomic particles, gamma rays, and nuclear x rays.**
>
> **Nuclear technology is the application of nuclear science to other sciences and engineering, and conversely, the application of other sciences and engineering to the problems of nuclear science.**

Part 1 identifies the major fields of nuclear science and technology into which *NSA* is divided. Subdivisions are listed under each field. Each subdivision is followed by statements of specific subject interest. These statements have been prepared to show the exact range and limits of subject interest for selecting literature abstracted and indexed in *NSA*.

Part 2 identifies the extent of interest in the chemical elements.

An index to Part 1 begins on page 22.

*NSA* covers reports, journals, books, patents, reviews, theses, conferences, and other similar literature. Selection is based on subject content; nothing is excluded solely on the basis of form, origin, or language. Some of the general practices followed in selecting literature for *NSA* are as follows:

**1. Popular type articles are not included.**

**2. Textbooks below the graduate level are not included.**

**3. Theses below the doctoral level are not included.**

**4. Patents that have been filed in several countries are included only once.**

**5. Material existing only as abstracts or short summaries is not included except for papers summarized in the *Transactions of the American Nuclear Society*.**

**6. Material initially published in a language other than English may be included both when an item is published in the original language and when an item appears in an English language translation.**

**7. All U. S. Atomic Energy Commission research and development reports in printed form which have been made publicly available at the National Technical Information Service (NTIS) are included in *NSA*. Also included in *NSA* are the printed reports from the national nuclear energy organizations of the United Kingdom, Japan, Canada, Sweden, Denmark, Norway, Australia, and France which have been made publicly available at NTIS.**

**8. Related groups of engineering drawings and specifications are abstracted and indexed in *NSA* when they become publicly available.**

**9. As a general practice, material more than two years old is not included in *NSA*.**

A list of the journals scanned regularly and the abbreviations used appears in the January 15 issue of *Nuclear Science Abstracts* and is supplemented in the July 15 issue.

# Part 1

# SCOPE AND ARRANGEMENT

## 40.000 CHEMISTRY

### 40.100 Analytical and Separations Chemistry

[Analytical chemistry of isotopes, transactinides, actinides, lanthanides, Be, Cs, I, Kr, Mo, Nb, Pm, Rn, Ra, Ru, Sc, Sr, Ta, Tc, Te, Xe, Y, Zr, or any element or compound if the application is directly associated with nuclear technology. Analyses to determine reactor fuel burnup; burnup calculations are included under REACTOR TECHNOLOGY. Arrangement is according to analytical procedure. Information relative to analytical methods is included as indicated.]

**40.110 Activation and Nuclear Reaction Procedures**

The subject in general or descriptions of the method.

**40.120 Chemical and Spectral Procedures**

**40.130 Radiometric and Radiochemical Procedures**

Nuclear radiometric or radiochemical procedure, including properties of radioisotopes as sources in x-ray analyses. Routine tracer studies are excluded.

**40.140 Separation Procedures**

Separation procedures for transactinides, actinides, lanthanides, Be, Cs, I, Kr, Mo, Nb, Pm, Rn, Ra, Ru, Sc, Sr, Ta, Tc, Te, Xe, Y, Zr, and any material of interest in nuclear technology except the procedures covered elsewhere, e.g., under Activation Procedures, Reactor Fuel Reprocessing, and Radioactive Waste Treatment.

### 40.200 Inorganic, Organic, and Physical Chemistry

**40.210 Chemical and Physicochemical Properties**

Chemical and physicochemical properties of nonradioactive elements, compounds, or mixtures directly associated with nuclear technology. Also includes the preparation of radioprotective compounds.

**40.220 Isotope Effects**

Isotope effects on nonnuclear chemical and physical properties. Isotope effects are excluded when used only as a tool in the analysis of reaction mechanisms or in structure studies.

**40.230 Isotope Exchange and Isotope Separation**

Isotope exchange if the exchange is of primary concern or the exchange mechanism is used in isotope separation.

Chemical and physicochemical isotope separations are included here; but industrial scale processes such as gaseous diffusion and centrifugation are included under ISOTOPE AND RADIATION SOURCE TECHNOLOGY. Radioisotope production is included under Radiochemistry and Nuclear Chemistry.

**40.240 Feed Materials Processing**

Chemical processing of ores for recovery of uranium or thorium, including all extraction, conversion, or reduction steps. Also includes chemical engineering of plants for such processing, but site surveys and environmental impact are included under ENVIRONMENTAL AND EARTH SCIENCES.

### 40.300 Radiation Chemistry

[The radiations considered here include accelerated ions, gamma radiation, x radiation, bremsstrahlung, neutrons, protons, alpha particles, beta particles, deuterons, and other subatomic particles. Ultraviolet, infrared, and visible radiations are not included.]

Radiation effects on the chemical and physicochemical properties of any element, compound, or mixture. General papers on solvated electrons and hydroxyl radicals are also included. Radiation effects on the biological activity of biochemicals in vitro or in vivo and all information on radiation effects on biochemicals in living organisms are included under LIFE SCIENCES. Radiation effects on metallurgical or solid state properties are included under MATERIALS or PHYSICS (SOLID STATE).

### 40.400 Radiochemistry and Nuclear Chemistry

Radiochemistry and nuclear chemistry are included without restrictions except for tracer applications and labeled compound preparation, which are included only if there is a contribution to the technology. Include those items that detail the technology, but exclude those in which no change in methodology is indicated.

**40.410 Hot-Atom Chemistry**

Any aspect, including recoil production and reactions.

**40.420 Properties of Radioactive Materials**

Chemical and physicochemical properties of radioactive elements or materials, including the stability of labeled compounds and chemical decontamination of surfaces or work areas. Decontamination of reactor vessels following accidents is included under REACTOR TECHNOLOGY.

**40.430 Radioactive Waste Treatment**

Radioactive waste processing for concentration, decontamination, or fission product recovery.

Waste disposal monitoring is included under ENVIRONMENTAL AND EARTH SCIENCES; waste disposal is included under NUCLEAR MATERIALS AND WASTE MANAGEMENT.

### 40.440 Radioisotope Production

Radioisotope production processes involving chemical separations. Development and uses of radioisotope radiation sources are included under ISOTOPE AND RADIATION SOURCE TECHNOLOGY.

### 40.450 Reactor Fuel Reprocessing

Reactor fuel processing, including analytical control, chemical separations, solvent studies, and plant and process design, performance, and operation. Environmental monitoring and impact are included under ENVIRONMENTAL AND EARTH SCIENCES.

## 42.000 ENGINEERING

### 42.100 Energy Conversion

Equipment and methods for the conversion of energy directly into electric energy, e.g., thermionic, thermoelectric, MHD, etc., and the production of electric energy through novel or previously undeveloped technology. Energy conversion economics is included under GENERAL-Energy Economics.

### 42.200 Facilities and Equipment

Design, construction, operation, and applied mechanics studies (stress, strain, motion, vibration, elasticity, deformation, etc.) of nuclear facilities and equipment including components of such facilities and equipment, e.g., irradiation plants, pilot plants, laboratories, etc. Only those facilities and equipment are included here for which a more appropriate category has not been provided. In general, information on facilities and equipment is included under categories more closely related to the purpose of the facility or equipment, e.g., CHEMISTRY, PARTICLE ACCELERATORS, REACTOR TECHNOLOGY AND REGULATION. Remote handling equipment is included under NUCLEAR MATERIALS AND WASTE MANAGEMENT.

### 42.300 Heat Transfer and Fluid Flow

Heat transfer and fluid flow if nucleate boiling, boiling burnout, critical heat flux, two-phase flow, flow in rod bundles, or liquid metals are considered. Heat transfer or fluid flow applied in nuclear technology is included under sections for the application.

### 42.400 Materials Testing

Destructive or nondestructive materials testing if a direct application to nuclear technology is indicated and if categorization on the basis of application would be less appropriate. In general, information on component testing is included under categories more closely related to the component, e.g., information on reactor fuel element testing is included under REACTOR TECHNOLOGY.

The use of radioisotopes and radiation sources in radiographic or radiometric testing is included under ISOTOPE AND RADIATION SOURCE TECHNOLOGY.

### 42.500 Nuclear Explosions

Detection of nuclear explosions and civil uses of nuclear explosions, including simulations using non-nuclear explosives.

### 42.600 Protective Structures and Equipment

Structures and equipment designed primarily for equipment and personnel protection, e.g., blast and fallout shelters, shielding (except for accelerator and reactor shielding), clean rooms, air filtration systems, fire protection systems, masks, and special clothing. The fabrication of bulk shielding is included under MATERIALS, shielding calculations are included under PHYSICS (RADIATION AND SHIELDING), and remote-handling equipment is included under NUCLEAR MATERIALS AND WASTE MANAGEMENT.

### 42.700 Safety Engineering

Safety at nuclear facilities if no more appropriate category is provided. In general, safety engineering information is included under categories for specific activities or facilities, e.g., Nuclear Explosions or REACTOR TECHNOLOGY.

### 42.800 Vacuum Engineering

Ultrahigh ($10^{-9}$ torr or greater) vacuum systems and equipment if no nuclear application is indicated. Applied vacuum engineering is included under categories for the applications, e.g., PARTICLE ACCELERATORS.

## 44.000 ENVIRONMENTAL AND EARTH SCIENCES

### 44.100 Minerals and Ores

Identification, properties, prospecting, mining, and estimated reserves of thorium and uranium minerals and ores (including equipment). Chemical processing of ores is included under CHEMISTRY.

### 44.200 Radioactive Effluents

Concentration or levels of radioactive materials discharged to the natural environment (atmosphere, soil, and waters) under accident or normal operating conditions at nuclear facilities.

### 44.300 Radioactivity Monitoring and Transport

Monitoring and/or transport and distribution of radioactive materials (including natural radioactivity) in or through the atmosphere, soil, or waters of the earth. Also includes monitoring and radiation hazards presented by radioactive materials in ecosystems or food cycles. Instrumentation for monitoring radioactivity is included under INSTRUMENTATION.

### 44.400 Radiometric Techniques

Use of radioisotopes or radiation sources in investigations of the environment or the earth, e.g., soil and water movement, isotopic methods of geochronology, etc., if the technique is of primary concern or is presented as an advancement of the technology. Instrument design is included under INSTRUMENTATION.

### 44.500 Site Surveys

Evaluation and selection of sites for nuclear installations such as fuel fabrication plants, radiochemical processing plants, and nuclear explosions. Seismological and background radiation surveys are included. Ecological studies of sites for nuclear facilities and sites for radiological research are also included. Nuclear power plant siting is included under REACTOR TECHNOLOGY.

### 44.600 Thermal Effluents

Characteristics, quantities, and effects of thermal discharges to the atmosphere, soil, or waters of the earth from chemical plants, both fossil- and nuclear-fueled power plants, or any other facility with thermal discharges of the same order of magnitude.

### 44.700 Chemical Effluents

Characteristics, quantities and effects of nonradioactive chemical discharges to the atmosphere, soil, or waters of the earth from nuclear facilities such as reactors, gaseous diffusion plants, fuel reprocessing plants, etc. Chemical effluents considered in comparative studies of energy production methods are also included.

## 46.000 INSTRUMENTATION

### 46.100 Radiation Detection Instruments

Arrangement is as follows:
- General Detectors and Monitors
- Radiation Dosimeters
- Nuclear Spectroscopic Instrumentation (Includes Moessbauer spectrometers)
- High-Energy Physics Instrumentation

### 46.200 Radiometric Instruments

Any instrument employing a radiation source and/or radiation detector in its operation.

### 46.300 Radiation Effects on Instrument Components, Instruments, or Electronic Systems

### 46.400 Miscellaneous Instruments

Limited to instruments, instrument components, or instrumentation systems for application in nuclear technology.

## 47.000 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

### 47.100 Isotope Separation (Industrial)

Industrial processes for heavy water production, uranium enrichment, or other isotope separation.

### 47.200 Isotopic Power Sources

Use of radioisotopes (fission products) as sources of electric, propulsive, or thermal energy.

### 47.300 Radiation Sources

Design or fabrication of radiation sources, including neutron sources, but not accelerators or reactors. Use of radiation sources in industrial processes such as food processing, sterilization of medical supplies, polymer production, etc. Basic radiation effects are included under CHEMISTRY or LIFE SCIENCES, but information on radiation effects that influence product acceptability or marketability, such as color or taste, is included here.

## 48.000 LIFE SCIENCES

[For this section the term RADIATION is defined as nuclear particles, accelerated electrons and ions, and $\gamma$ and x radiations. Information on uv effects is included *only* if microorganisms, cells, or biochemicals are the subjects of study. Laser radiation, magnetic fields, microwaves, and sunlight are excluded. The concept of RADIATION EFFECTS includes the effect itself, radiomimetic effects, and any information relating to the effect, e.g., information on assessment, prevention, alteration, transmission, reversal, recovery, etc., and information on the determination or influence of experimental variables such as dose, dose rate, LET, etc. This includes modification of radiation effects by radioprotective or effect-enhancing substances and studies on these substances to establish their independent effects. Theoretical aspects of dose determination or measurement in tissue equivalent materials or phantoms are included under PHYSICS (RADIATION AND SHIELDING).]

### 48.100 Radiation Effects on Biochemicals

Effects on biochemicals in living organisms and on their biological activity; information on other effects on biochemicals outside living organisms is included under CHEMISTRY. Also includes the preparation of materials for irradiation and irradiation procedures. The preparation of the radiation sources is included under CHEMISTRY or ISOTOPE AND RADIATION SOURCE TECHNOLOGY.

### 48.200 Radiation Effects on Cells

Effects of radiation from external or internal sources on cells in vitro, including cells in cultures; effects on in vivo cells are included in other LIFE SCIENCES categories for entire organisms. Also includes information on the preparation of materials for irradiation and irradiation procedures. The preparation of the radiation sources is included under CHEMISTRY or ISOTOPE AND RADIATION SOURCE TECHNOLOGY.

### 48.300 Radiation Effects on Microorganisms

Effects on microorganisms, including bacteria, protozoa, unicellular algae, fungi, and yeasts. Uses of radiation in industrial processes for the radiopreservation of food, radiosterilization of medical supplies, radiation preparation of vaccines, etc., are included under ISOTOPE AND RADIATION SOURCE TECHNOLOGY unless effects on specific organisms are considered.

### 48.400 Radiation Effects on Plants

Effects on plants (including multicellular algae and in vivo studies on plant cells), of external-source radiations including the preparation of materials for irradiation and irradiation procedures. The preparation of the radiation sources is included under CHEMISTRY or ISOTOPE AND RADIATION SOURCE TECHNOLOGY. Industrial processes for radiopreservation or disinfestation of foods is under ISOTOPE AND RADIATION SOURCE TECHNOLOGY.

### 48.500 Radiation Effects on Animals

#### 48.510 Man

Effects of external-source or implanted-source radiations on man or on human tissues or cells in vivo. Therapeutic irradiation is included *only* if there is significant information on the effects on normal tissues, if evaluations are made for new radiation sources, e.g., pion beams, or if a contribution is made to the technology. Include those items that detail the technology, but exclude those in which no change in methodology is indicated.

### 48.520 Vertebrates

Effects of external-source or implanted-source radiations on vertebrates or on vertebrate tissues or cells in vivo, including the preparation of animals for irradiation and irradiation procedures. The preparation of radiation sources is included under CHEMISTRY or ISOTOPE AND RADIATION SOURCE TECHNOLOGY.

### 48.530 Invertebrates

Effects on invertebrates or on invertebrate tissues or cells in vivo, including the preparation of the organism for irradiation and irradiation procedures. The preparation of radiation sources is included under CHEMISTRY or ISOTOPE AND RADIATION SOURCE TECHNOLOGY. Industrial scale processes for pest control and crop disinfestation are included under ISOTOPE AND RADIATION SOURCE TECHNOLOGY unless there is significant information on the effects of radiation on specific organisms.

### 48.600 Radionuclide Effects (Internal Source)

[Absorbed or incorporated radioactive materials, not implanted sources, in any in vivo studies.] Internal source evaluation and effects, including experimental procedures, but not the preparation of labeled compounds for administration.

### 48.700 Nuclide Kinetics and Toxicology

Kinetics and toxicology of deuterium and radionuclides in or on living organisms. Also includes contamination and decontamination, both internal and external, of living organisms. Levels and movement of radionuclides through man's environment are included under ENVIRONMENTAL AND EARTH SCIENCES.

### 48.800 New Tracer Techniques

Use of isotope tracers in LIFE SCIENCES research, e.g., animal husbandry, disease and pest control, ecology, medicine, if a contribution is made to the evaluation and technology of tracer usage. Include those items that detail the technology, but exclude those in which no change in methodology or application is indicated. Also includes extensive bibliographies or reviews.

## 50.000 MATERIALS

Corrosion, erosion, surface phenomena, preparation, fabrication, properties (including solid-state), and phase studies are included with the limitations indicated in the arrangement scheme below.

### 50.100 Ceramics and Cermets

Limited to the borides, carbides, hydrides, nitrides, and oxides of those elements in Part 2 in which a metallurgy interest is indicated.

### 50.200 Metals and Alloys

Limited to those elements in Part 2 in which a metallurgy interest is indicated.

### 50.300 Other Materials

Limited to materials applied or specifically for application in nuclear technology, e.g., carbon, graphite, concretes, plastics.

Radiation damage in or radiation effects on any material with the following exceptions:

Radiation effects on biological materials are included under LIFE SCIENCES.

Radiation effects on chemical or physicochemical properties are included under CHEMISTRY.

## 52.000 NUCLEAR MATERIALS AND WASTE MANAGEMENT

Equipment, methods, standards, and systems, for safeguarding and management of materials of nuclear interest, e.g., fissionable materials, radioactive materials, radioactive wastes, or materials of special interest such as heavy water. The arrangement is as follows:

### 52.100 Accountability and Safeguards

Research and development on equipment, methods, and systems to guard against the diversion of nuclear materials from uses permitted by law or treaty.

### 52.200 Disposal and Storage

Studies, including economic, related to methods for the management, disposal, or storage of radioactive wastes, e.g., land burial, sea disposal, tank storage, or salt mine storage. Geological, hydrological, and seismological studies related to waste disposal are included. Monitoring, transport, and distribution of radioactive materials in the atmosphere, soil, and waters of the Earth are included under ENVIRONMENTAL AND EARTH SCIENCES.

### 52.300 Handling Equipment and Procedures

Design, construction, and operation of equipment and facilities for handling radioactive materials, e.g., remote-handling equipment, glove boxes, and hot cells. Non-reactor criticality studies are included.

### 52.400 Transportation

Regulatory and administrative aspects of radioactive materials shipping. Design, development, evaluation, and testing of radioactive materials shipping containers.

Radioactive waste processing is included under CHEMISTRY.

## 54.000 PARTICLE ACCELERATORS

Particle, ion, atom, or molecule accelerators. The arrangement is as follows:

### 54.100 Design, Development, and Operation

### 54.200 Auxiliaries and Components

### 54.300 Ion Sources and Injection and Extraction Systems

### 54.400 Ion Optics and Field Calculations

### 54.500 Storage Rings

### 54.600 Experimental Facilities (Includes Radiation Targets)

## 56.000 PHYSICS (ASTROPHYSICS AND COSMOLOGY)

### 56.100 Cosmic Radiation

Cosmic radiation, including exposure ages and induced radioactivity of extraterrestrial material, e.g., meteorites and lunar material. Cosmic-ray interactions with the atmosphere and with the geomagnetic field are included under PHYSICS (ATMOSPHERIC).

### 56.200 Stars

Composition, evolution, physical conditions, and nucleogenesis of stars; including neutron stars, black holes, and other starlike objects. Celestial mechanics and routine astronomical observations, e.g., sky surveys, are excluded.

### 56.300 Quasi-Stellar, Radio, and X-Ray Sources

Theory, detailed studies, and location of such objects.

### 56.400 Solar Phenomena

Sunspots and solar prominences, disturbances, wind, flares, radio bursts, magnetic fields, structure, and spectra. Solar wind interactions with the atmosphere or geomagnetic field are included under PHYSICS (ATMOSPHERIC).

### 56.500 Galaxies

Formation, structure, and evolution of galaxies, characteristics of interstellar medium, and identification of molecular species in space.

### 56.600 Cosmology

Structure and evolution of the Universe, gravitational collapse and detection of gravitational waves, and tests of general relativity. Gravitational wave detectors are included under INSTRUMENTATION. General relativity theory and field theories of gravitation are included under PHYSICS (HIGH-ENERGY).

### 56.700 Planetary Phenomena

Interplanetary magnetic fields, radio emissions from planets, natural radioactivity of extraterrestrial materials, formation and evolution of planetary systems (including the solar system), and radiation belts. Van Allen belts are included under PHYSICS (ATMOSPHERIC).

## 58.000 PHYSICS (ATMOSPHERIC)

### 58.100 Auroral and Ionospheric Phenomena

Associated particle kinetics only.

### 58.200 Effects of Nuclear Detonations

Atmospheric effects only.

### 58.300 Magnetospheric Phenomena

## 60.000 PHYSICS (ATOMIC AND MOLECULAR)

### 60.100 Beams and Their Reactions

Methods of production and techniques of using atomic, electron, ion, and molecular beams.

Electron and ion sources not developed for specific applications.

Reactions of beams with materials in bulk (e.g., scattering by surfaces, secondary emission, sputtering yields, etc.)

### 60.200 Atomic and Molecular Properties

Atomic properties (experimental and theoretical studies) of helium, hydrogen (also deuterium and tritium), the lanthanides, scandium, technetium, yttrium, and elements having $Z > 84$.

Molecular properties of deuterium, helium ($He_2$, $He_3$, etc.), helium hydrides, hydrogen ($H_2$, $H_2^+$, $H_3^+$, etc.), tritium, and compounds of technetium and of elements having $Z > 84$.

### 60.300 Positronium, Muonium, and Muonic and Mesic Atoms and Molecules

Properties of positronium, muonium, and muonic and mesic ($\pi$, K, etc.) atoms and molecules. Exotic atoms (involving antiprotons, hyperons, etc.) are included under PHYSICS (HIGH-ENERGY).

Basic mechanisms of positron annihilation, but not studies using positron annihilation as a tool.

### 60.400 Collision Phenomena

Experimental and theoretical studies of elastic scattering, charge exchange (electron capture, electron loss, and electron attachment or detachment), excitation (deexcitation, excitation transfer), ionization, or dissociation in collisions of the following type: electron–ion, electron–atom, electron–molecule, ion–ion, ion–atom, ion–molecule, atom–atom, and atom–molecule.

Rearrangement collisions ($A + BC \rightarrow AB + C$), chemical exchange, and collisions in confined gases when no external beam is involved are excluded.

### 60.500 Atomic Theory

Theory of atomic structure and properties when generally applicable. For theoretical studies of specific elements, see first statement under Atomic and Molecular Properties.

## 62.000 PHYSICS (ELECTROFLUID AND MAGNETOFLUID)

Electrofluid and magnetofluid mechanics only.

## 64.000 PHYSICS (HIGH-ENERGY)

### 64.100 Particle Interactions and Properties (Experimental)

Experimental studies on the electromagnetic, weak, and strong interactions; on properties of particles and radiation quanta; on hypernuclei and hyperonic or antiprotonic atoms; and on particle or radiation quanta reactions with nuclei above the pion production threshold (~400 MeV). Information on the energy range below 400 MeV is included under PHYSICS (NUCLEAR).

### 64.200 Particle Interactions and Properties (Theoretical)

Theoretical studies on the electromagnetic, weak, and strong interactions; on properties of particles and radiation quanta; on hypernuclei and hyperonic or antiprotonic atoms; and on particle or radiation quanta reactions with nuclei above the pion production threshold (~400 MeV). Information on the energy range below 400 MeV is included under PHYSICS (NUCLEAR).

### 64.300 Particle Invariance Principles and Symmetries

Space-time symmetries and internal symmetries of particles and the applications of these symmetries to the electromagnetic, weak, and strong interactions.

### 64.500 Scattering Theory

General scattering theory only; the application of scattering theory to specific interactions or types of particles is included under sections according to type of interaction.

NOTE: Category 64.400 (Field Theories) is discontinued. This subject area is now included in 76.000 PHYSICS (THEORETICAL).

## 66.000 PHYSICS (LOW-TEMPERATURE)

Superfluidity, superconductivity, and equipment and devices when emphasis is on the superconductor or superfluid. Applications of superconducting devices are included under sections according to application; e.g., PARTICLE ACCELERATORS.

## 68.000 PHYSICS (NUCLEAR)

The arrangement is as follows:

### 68.100 Neutron Interactions with Matter

Neutron absorption, scattering, thermalization, transport, etc., in macroscopic systems, including solution of the neutron transport equation and theoretical neutron transport in matter in general geometric configurations.

### 68.200 Nuclear Properties and Reactions $A \leq 5$

Mass, charge distribution, binding energy, radioactive decay, energy levels and transitions, moments and spin, and nuclear reactions and scattering of specific nuclei, spontaneous and induced fission.

### 68.300 Nuclear Properties and Reactions $6 \leq A \leq 19$

Mass, charge distribution, binding energy, radioactive decay, energy levels and transitions, moments and spin, and nuclear reactions and scattering of specific nuclei, spontaneous and induced fission.

### 68.400 Nuclear Properties and Reactions $20 \leq A \leq 38$

Mass, charge distribution, binding energy, radioactive decay, energy levels and transitions, moments and spin, and nuclear reactions and scattering of specific nuclei, spontaneous and induced fission.

### 68.500 Nuclear Properties and Reactions $39 \leq A \leq 58$

Mass, charge distribution, binding energy, radioactive decay, energy levels and transitions, moments and spin, and nuclear reactions and scattering of specific nuclei, spontaneous and induced fission.

### 68.600 Nuclear Properties and Reactions $59 \leq A \leq 89$

Mass, charge distribution, binding energy, radioactive decay, energy levels and transitions, moments and spin, and nuclear reactions and scattering of specific nuclei, spontaneous and induced fission.

### 68.700 Nuclear Properties and Reactions $90 \leq A \leq 149$

Mass, charge distribution, binding energy, radioactive decay, energy levels and transitions, moments and spin, and nuclear reactions and scattering of specific nuclei, spontaneous and induced fission.

### 68.800 Nuclear Properties and Reactions $150 \leq A \leq 189$

Mass, charge distribution, binding energy, radioactive decay, energy levels and transitions, moments and spin, and nuclear reactions and scattering of specific nuclei, spontaneous and induced fission.

### 68.900 Nuclear Properties and Reactions $190 \leq A \leq 219$

Mass, charge distribution, binding energy, radioactive decay, energy levels and transitions, moments and spin, and nuclear reactions and scattering of specific nuclei, spontaneous and induced fission.

### 69.100 Nuclear Properties and Reactions $A \geq 220$

Mass, charge distribution, binding energy, radioactive decay, energy levels and transitions, moments and spin, and nuclear reactions and scattering of specific nuclei, spontaneous and induced fission.

### 69.200 Nuclear Theory

Nuclear structure, nuclear matter, nuclear reactions and scattering, nuclear moments and spin, radioactive decay, spontaneous and induced fission, and nuclear models.

## 70.000 PHYSICS (PLASMA AND THERMONUCLEAR)

Plasma and thermonuclear physics, except solid-state plasma, arranged as follows:

### 70.100 Confinement and Heating

### 70.200 Diagnostics

### 70.300 Kinetics (General)

### 70.400 Kinetics (Experimental)

### 70.500 Kinetics (Theoretical)

### 70.600 Production

### 70.700 Stability

### 70.800 Thermonuclear Engineering and Equipment

### 70.900 Wave Phenomena

## 72.000 PHYSICS (RADIATION AND SHIELDING)

### 72.100 Radiation Physics

Basic physical characteristics of radiation or of radiation passage through or scattering from materials not generally defined as shielding. This includes experimental or theoretical studies of range-energy relations, energy loss mechanisms, and absorption mechanisms, and calculations of dose distribution in tissue equivalent materials or phantoms. Dose determinations in biological materials is included under LIFE SCIENCES. Neutron transport in macroscopic systems is included under PHYSICS (NUCLEAR).

### 72.200 Radiation Protection Standards

Standards written for a specific circumstance are included under appropriate sections.

### 72.300 Radiation Source Calibration and Standardization

Radiation source design and fabrication or radiation source preparation are included under ISOTOPE AND RADIATION SOURCE TECHNOLOGY or CHEMISTRY.

### 72.400 Shielding Calculations and Experiments

Neutron shielding and shield fabrication are included under PHYSICS (NUCLEAR) and MATERIALS. Shield design is included under sections for the application, e.g., PARTICLE ACCELERATORS or REACTOR TECHNOLOGY.

## 74.000 PHYSICS (SOLID-STATE)

This category is discontinued. Information on the solid-state properties of materials is now included in category 50.000 (MATERIALS).

## 76.000 PHYSICS (THEORETICAL)

### 76.100 General

Theoretical physics applicable to nuclear science (e.g., general quantum theory and mathematical physics) but not specifically applied. Theoretical physics when applied is arranged according to application.

### 76.200 Quantum Field Theories

Basic studies of quantum field theories and quantum electrodynamics.

### 76.300 Gravitation and General Relativity

Basic studies of gravitation theory and general relativity theory. Gravitational collapse, gravitational wave detection, and tests of general relativity are included under PHYSICS (ASTROPHYSICS AND COSMOLOGY).

## 77.000 REACTOR TECHNOLOGY AND REGULATION

Design, development, construction, and operation of nuclear fission reactors.

Includes: fuel elements; cooling systems; pressure vessels; shielding; loading machines; steam and power conversion systems; components; auxiliary systems; accessories.

Excludes: control systems (use 79.400); economics (use 79.500); fuel cycle economics (use 79.600); fuels, general aspects (use 79.300); safety and siting (use 77.900); nuclear insurance (use 77.910).

### 77.100 Power Reactors, Non-Breeding, Light-Water Moderated, Boiling Water Cooled

Includes: BWR-type.

### 77.200 Power Reactors, Non-Breeding, Light-Water Moderated, Non-Boiling Water Cooled

Includes: PWR-type.

### 77.300 Power Reactors, Non-Breeding, Graphite Moderated

Includes: GCR, AGR, HTGR, Molten Salt types.

### 77.400 Power Reactors, Non-Breeding, Otherwise Moderated or Unmoderated

Includes: Heavy Water type.

### 77.500 Power Reactors, Breeding

Includes: LMFBR, MSBR, GCFR.

### 77.600 Research, Test, Experimental, Zero-Power, and Training Reactors and Subcritical Assemblies

### 77.700 Plutonium Production, Isotope Production, Chemonuclear, Materials Testing, and Material Processing Reactors

### 77.800 Space, Mobile, Propulsion, Transportable, and Package Reactors

### 77.810 Nuclear Ships Licensing and Regulation

Safe-navigation regulations.

### 77.900 Reactor Safety and Environmental Aspects

Reactor accident analysis, safety system performance (e.g., ECCS), environmental consequences of reactor construction and operation, including nonradioactive aspects, in-reactor facility waste processing and radiation protection.

#### 77.910 Reactor Accident Liability

Legal aspects of nuclear damage and risk, insurance, and financial security.

### 79.100 Reactor Theory and Calculation

Reactor physics calculations and in-pile measurements (in reactors of any type).

Includes: criticality; dynamics; kinetics; lattice cell parameters; neutronics; physics; thermohydraulics.

### 79.200 Reactor Components and Accessories

Design, construction, assembly, and performance—where no reactor type is specified.

Includes: buildings; coolants; cooling systems; loading machines; pressure vessels; shielding; structures.

### 79.300 Reactor Fuels

Design, assembly, and performance of fuel elements and assemblies, fuel cycles, fuel handling procedures, and fuel requirements—where no reactor type is specified.

Excludes: production and fabrication of fuel element component materials; burnup in specific reactors types (use 77.100–77.800); fuel cycle economics (use 79.600); loading machines (use 79.200).

### 79.400 Reactor Control Systems

Systems for the control and surveillance of reactors of any type.

Includes: control elements and incorporated instruments; control element drive units; control by computers; data processing and display systems; systems for alarm and automatic shutdown; automatic initiation of protective systems or actions.

Excludes: instruments of potential use in control systems; safety and protective systems (e.g., ECCS).

### 79.500 Nuclear Power Plant Economics

General studies of power plant construction and operation.
Excludes: fuel cycle economics (use 79.600).

### 79.600 Reactor Fuel Cycle Economics

Fuel resources and requirements and overall fuel cycle costs.

### 79.700 Reactor Licensing and Regulation

All reactor Docket material (must have secondary category to type, e.g., 77.100, 77.200, and any other appropriate category), general licensing procedures and regulations.

## 80.000 GENERAL

### 80.100 Civilian Defense

Administrative and planning aspects only.

### 80.200 Energy Utilization and Economics

Economic and feasibility studies of nonnuclear energy source development and utilization.

Include:

1. Technical results from energy research activities (e.g., coal gasification or desulfurization and synthetic fuel development).
2. Developing technology in electric power generation (e.g., combined cycles) and transmission (e.g., EHV and UHV systems).
3. Comprehensive survey articles on energy sources (solar, geothermal, tides, winds, other) or on energy production and distribution, utilization, conservation, or conversion.

Do Not Include:

1. Popular-type articles.
2. Articles concerning conventional-type hardware (e.g., motors, generators, circuit breakers, gas turbines, gas-transmission equipment, etc.).

Note: Equipment and methods for energy conversion are included under ENGINEERING—Energy Conversion.

### 80.300 Information Handling

Manual or computer-based systems for data or information acquisition, processing, transmission and retrieval.

### 80.400 Law

Legislative action and activities of agencies, committees, or organizations.

### 80.500 Management

Organization, administration, financing, and general description of nuclear institutes and programs, e.g., directories, reference books, manuals, lists of publications, general bibliographies, training programs, etc.

### 80.600 Mathematics and Computers

Mathematical methods and models and computer codes and programs for solving problems not related to nuclear science.

### 80.700 Miscellaneous

Publicly available administrative and research and development reports from the United States Atomic Energy Commission and the national nuclear energy organizations of the United Kingdom, Canada, Sweden, Denmark, Japan, Australia, France, West Germany, and Norway which are outside the subject scope of other categories.

# Part 2

# EXTENT OF INTEREST IN THE ELEMENTS

**ACTINIUM**

All scientific and technical aspects

**ALUMINUM**

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

**AMERICIUM**

All scientific and technical aspects

**ANTIMONY**

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

**ARGON**

Applications of the element in nuclear technology or the behavior of the element in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

**ARSENIC**

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

**ASTATINE**

All scientific and technical aspects

**BARIUM**

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

**BERKELIUM**

All scientific and technical aspects

**BERYLLIUM**

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state properties

**BISMUTH**

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of liquid bismuth

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

**BORON**

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state properties

**BROMINE**

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

**CADMIUM**

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state properties

**CALCIUM**

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

**CALIFORNIUM**

All scientific and technical aspects

**CARBON**

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Properties and fabrication of nuclear-grade graphite and graphite fuel materials

Radiation effects

Radiochemistry

**CERIUM**

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state properties

**CESIUM**

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

**CHLORINE**

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

**CHROMIUM**

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

**COBALT**

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

**COPPER**

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

**CURIUM**

All scientific and technical aspects

**DYSPROSIUM**

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application) compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state properties

**EINSTEINIUM**

All scientific and technical aspects

**ERBIUM**

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state properties

**EUROPIUM**

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

Solid-state properties

**FERMIUM**

All scientific and technical aspects

**FLUORINE**

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

**FRANCIUM**

All scientific and technical aspects

**GADOLINIUM**

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry
Solid-state properties

**GALLIUM**

Applications of the element and its alloys, compounds, and systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

**GERMANIUM**

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions
Radiation effects
Radiochemistry

**GOLD**

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

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**HAFNIUM**

Applications of the element and its alloys, compounds, and systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

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Applications of the element in nuclear technology or the behavior of the element in an actual or a simulated reactor environment

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Metabolism, tissue distribution, and toxicology of radioisotopes

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**HOLMIUM**

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

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**HYDROGEN**

Applications of the element or its compounds and systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of deuterium and tritium

Nuclear properties and nuclear reactions

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## INDIUM

Applications of the element and its alloys, compounds, and systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

Nuclear properties and nuclear reactions

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## IODINE

Analysis, determination, and separation

Applications of the element or its compounds or systems in nuclear technology or the behavior of the element, its compounds, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

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## IRIDIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Nuclear properties and nuclear reactions

Radiation effects

Radiochemistry

## IRON

Applications of the element and its alloys or systems, including steel and stainless steel, in nuclear technology or the behavior of the element, its alloys, or its systems in an actual or a simulated reactor environment

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

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## KRYPTON

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Applications of the element in nuclear technology or the behavior of the element in an actual or a simulated reactor environment

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## LEAD

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Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

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### LUTETIUM

Analysis, determination, and separation

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

Atomic properties

Isotopes (excluding routine applications as tracers or radiation sources)

Metabolism, tissue distribution, and toxicology of radioisotopes

Metallurgy of the element or its alloys (steels containing this element are excluded unless the study concerns an actual or simulated nuclear application), compounds, or systems, excluding mineralogy

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### MAGNESIUM

Applications of the element or its alloys, compounds, or systems in nuclear technology or the behavior of the element, its alloys, compounds, or systems in an actual or a simulated reactor environment

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Geomagnetic Field, 58.40
Geothermal Energy, 80.20
Glove Boxes, 42.60
Graphite, 50.30
Gravitation, 76.30
Handling Equipment, 52.30
Handling Procedures, 52.30
Health Physics, 40.42, 44.20, 44.30, 48.00, 72.00
Heat Sources, 47.20
Heat Transfer, 42.30, 77.00
Heated Effluents, 44.60
Heavy Water, Management, 52.00
Heavy Water, Production, 47.10
Helium Hydrides, 60.20
Helium, Superfluid, 66.00
High-Energy Physics, 64.00
High-Energy Physics Instrumentation, 46.10
Hot-Atom Chemistry, 40.41
Hot Cells, 42.60
Human Cells, 48.50
Human Tissues, 48.50
Hydrides, 50.10
Hydrology, 44.00
Hypernuclei, 64.00
Hyperonic Atoms, 64.00
Information Handling, 80.30
Inorganic Chemistry, 40.20
Instrument Components, 46.30
Instrumentation, 46.00
Instrumentation Systems, 46.40
Instruments, 46.30, 46.40
Invariance Principles, 64.30
Invertebrates, 48.50
Ion Beams, 60.10
Ion Extraction, 54.30
Ion Injection, 54.30
Ion Optics, 54.40
Ion Sources, 60.10
Ion Sources, Accelerator, 54.30
Ionization, 60.40
Ionospheric Phenomena, 58.10
Irradiation Procedures, 48.10, 48.20, 48.40, 48.50
Isotope Dilution Analysis, 40.10
Isotope Effects, 40.22
Isotope Exchange, 40.23
Isotope Separation, Chemical, 40.23
Isotope Separation, Industrial, 47.10
Isotope Technology, 47.00
Labeled Compounds, 40.40, 40.42
Law, 80.40
Life Sciences, 48.00
Liquid Metals, 42.30
Low-Temperature Physics, 66.00
Magnetic Fields, Interplanetary, 56.70
Magnetic Fields, Solar, 56.40
Magnetic Properties, 50.00
Magnetofluid Mechanics, 62.00
Magnetohydrodynamic Generators, 42.10
Man, 48.50
Management, 80.50
Manuals, 80.50
Masks, 42.60
Materials, 50.00
Materials Testing, 42.40
Mathematical Physics, 76.20
Mathematics, 80.60
Matter, 68.10
Medical Supplies, 47.30
Mesic Atoms, 60.30
Metals, 42.30, 50.20, 74.00
Meteorites, 56.10
MHD Generators, 42.10
Microorganisms, 48.30
Minerals, 44.10
Mining, 44.10
Miscellaneous Reports, 80.70
Moessbauer Effect, 74.30
Moessbauer Spectrometers, 46.10
Molecular Beams, 60.10
Molecular Physics, 60.00
Molecular Properties, 60.20
Muonic Atoms, 60.30
Muonium, 60.30
Natural Radioactivity, 44.30
Neutron Interactions, 68.10
Neutron Sources, 47.30
Nitrides, 50.10, 74.00
Nonnuclear Energy Source Development, 80.20
Nuclear Chemistry, 40.40
Nuclear Explosions, Atmosphere Effects, 58.20
Nuclear Explosions, Civil Uses, 42.50
Nuclear Explosions, Site Surveys, 44.50
Nuclear Institutes and Programs, 80.50
Nuclear Magnetic Resonance, 50.00
Nuclear Materials Management, 52.00
Nuclear Matter, 69.20
Nuclear Models, 69.20
Nuclear Phenomena, Galactic, 56.50
Nuclear Physics, 68.00
Nuclear Power Plant Economics, 79.50
Nuclear Power Plants, 44.50, 77.00
Nuclear Properties, 68.00
Nuclear Reaction Analysis, 40.11
Nuclear Reactions, 40.10, 40.40, 64.10, 68.00, 69.10, 69.20
Nuclear Reactors, 77.00
Nuclear Spectroscopic Instruments, 46.10
Nuclear Structure, 69.20
Nuclear Theory, 69.20
Nucleate Boiling, 42.30
Nuclei, 64.00, 68.00, 69.10, 69.20
Nucleogenesis, 56.20
Nuclide Kinetics, 48.70
Nuclide Toxicology, 48.70
Oceanography, 44.00
Ores, Chemical Processing, 40.24
Ores, Geology, 44.10
Organic Chemistry, 40.20
Organisms, 48.70
Oxides, 50.10, 74.00
Particle Accelerators, 54.00

Particle Interactions, 64.00
Particle Invariance, 64.30
Particle Kinetics, 58.10
Particle Symmetry, 64.30
Particle Trapping, 58.30
Pest Control, 47.30
Phase Studies, 40.20, 40.40, 50.00
Physical Chemistry, 40.20
Physical Properties, 40.20, 40.40, 50.00
Physicochemical Properties, 40.21, 40.42
Planetary Phenomena, 56.70
Plankton, 48.30
Plant Cells, 48.40
Plants, 48.40
Plasma Physics, 70.00
Plasma Physics, Galactic, 56.50
Plastics, 50.30
Plowshare Project, 42.50
Polymer Production, 47.30
Positron Annihilation, 60.30
Positronium, 60.30
Power Plants, 44.60, 77.00
Power Sources, 47.20
Pressure Vessels, 77.00
Propulsion, 47.20, 77.80
Prospecting, 44.10
Protective Equipment, 42.60
Protective Structures, 42.60
Publication Lists, 80.50
Quantum Electrodynamics, 76.20
Quantum Field Theory, 76.20
Quantum Theory, 76.10
Quasi-Stellar Sources, 56.30
Radiation Belts, 56.70, 58.00
Radiation, Biological Effects, 48.00
Radiation Chemistry, 40.30
Radiation Detection Instruments, 46.10
Radiation Detectors, 46.10, 46.20
Radiation Dosimetry, 48.60
Radiation Effects, Biological, 48.00, 48.10, 48.20, 48.30, 48.40, 48.50, 48.60
Radiation Effects, Chemical, 40.30
Radiation Effects, Commodity Processing, 47.30
Radiation Effects, Instrument Systems, 46.30
Radiation Effects, Metallurgical, 50.00
Radiation Effects, Solid-State, 50.00
Radiation Environments, 42.60
Radiation, Galactic, 56.50
Radiation Hazards, 44.30
Radiation Interactions, 64.00
Radiation Monitoring, 44.30
Radiation Monitors, 46.10
Radiation Physics, 72.00
Radiation Protection Standards, 72.20
Radiation Quanta, 64.00
Radiation Scattering, 72.10
Radiation Source Calibration, 72.30
Radiation Source Standardization, 72.30
Radiation Source Technology, 47.00
Radiation Sources, Biological External, 48.10
Radiation Sources, Biological Internal, 48.60
Radiation Sources, Design, 47.30
Radiation Sources, Use in Earth Sciences, 44.40
Radiation Sources, Use in Instruments, 46.20
Radiation Surveys, 44.50
Radiation Targets, 54.60
Radiation Therapy, 48.51
Radiation Transport, 72.10
Radio Bursts, 56.40
Radio Emission, 56.70
Radio Sources, 56.30
Radioactive Decay, 40.41, 68.00, 69.10, 69.20
Radioactive Effluents, 44.20
Radioactive Materials, Biological Incorporation, 48.60
Radioactive Materials, Chemical Properties, 40.42
Radioactive Materials, Discharge to Environment, 44.20
Radioactive Materials, Management, 52.00
Radioactive Materials, Monitoring in Environment, 44.30
Radioactive Waste, Chemical Processing, 40.43
Radioactive Waste, Disposal, 44.20, 52.00
Radioactive Waste Management, 52.00
Radioactivity Monitoring, 44.30
Radioactivity Transport, 44.30
Radiochemical Analysis, 40.13
Radiochemical Processing Plants, 40.40, 44.20, 44.50, 44.60
Radiochemistry, 40.40
Radioisotope Production, 40.44
Radioisotopes, Analytical Use, 40.13
Radioisotopes, Distribution in Environment, 44.20, 44.30, 48.60, 48.70
Radioisotopes, Use in Biology, 48.80
Radioisotopes, Use in Earth Sciences, 44.40
Radioisotopes, Use in Industry, 47.30
Radioisotopes, Use in Power Sources, 47.20
Radiolysis, 40.30
Radiometric Analysis, 40.13
Radiometric Instruments, 46.20
Radiometric Techniques, 44.40
Radiomimetic Effects, 48.00
Radionuclide Effects, 48.60, 48.70
Radioprotective Substances, 48.00
Radiosterilization, 47.30
Radiotherapy, 48.50
Reactor Accident Liability, 77.91
Reactor Control Systems, 79.40
Reactor Engineering, 77.00
Reactor Fuel Cycle Economics, 79.60
Reactor Fuel Fabrication Plants, 44.20, 44.50, 50.00
Reactor Fuel Loading Machines, 79.20
Reactor Fuel Processing Plants, 40.45, 44.20, 44.50, 44.60
Reactor Fuels, Analysis, 40.10
Reactor Fuels, Burnup, 40.10, 77.00
Reactor Fuels, Design, 77.00
Reactor Fuels, Materials Properties, 50.00
Reactor Fuels, Reprocessing, 40.45
Reactor Licensing and Regulation, 79.70
Reactor Physics, 79.10
Reactor Technology, 77.00
Reactor Theory and Calculation, 79.10
Recoils, 40.41
Reference Books, 80.50
Refractory Materials, 50.30
Relativistic Mechanics, 76.30
Relativity Theory, 76.30
Remote-Handling Equipment, 52.30
Rod Bundles, 42.30
Safeguards, 52.10
Safety Engineering, 42.70
Scattering Theory, 64.50
Secondary Emission, 60.10

Seismology, 44.50
Shielding, 72.00, 77.00
Shielding Calculations, 72.40
Shielding Theory, 72.40
Shipping Containers, 52.40
Site Surveys, 44.50
Soil, 44.20, 44.30, 44.60
Soil Moisture, 44.40
Solar Energy, 80.20
Solar Flares, 56.40
Solar Phenomena, 56.40
Solar System, 56.40
Solar Wind, 56.40
Solar Wind Interactions, 58.40
Solid-State Properties, 50.00
Special Materials, 52.00
Spontaneous Fission, 68.00, 69.10, 69.20
Sputtering Yields, 60.10
Standards, 72.20
Stars, 56.20
Storage, 52.20
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Structures, 42.20, 42.60, 42.70, 44.20
Sun, 56.40
Sunspots, 56.40
Superconductivity, 66.20
Superconductors, 66.30
Superfluid Helium, 66.30
Superfluidity, 66.10
Testing, 42.40
Theoretical Physics, 76.00
Thermal Effluents, 44.60
Thermal Energy, 47.20
Thermionic Converters, 42.10
Thermoelectric Generators, 42.10
Thermonuclear Equipment, 70.80
Thermonuclear Physics, 70.00
Thermonuclear Processes, 70.80
Tidal Energy, 80.20
Tissues, 48.30, 48.40, 48.50, 48.60
Toxicology, 48.70
Tracer Techniques, 40.40, 44.40, 48.80
Training Programs, 80.50
Transportation, 52.40
Tritium, 40.10, 40.22, 40.23, 40.40, 47.10, 48.70, 52.00, 60.20
Two-Phase Flow, 42.30
Ultraviolet Radiation, 48.00
Universe, 56.60
Uranium Enrichment, 47.10
Vacuum Engineering, 42.80
Van Allen Belts, 58.00
Vertebrates, 48.50
Waste Disposal, 44.20, 52.00
Waste Management, 52.00
Waste Processing, 40.43
Water, 44.20, 44.30, 44.60
Well Logging, 44.40
Wind Energy, 80.20
X-Ray Analysis, 40.12, 40.13
X-Ray Sources, 56.30
Yeasts, 48.30

# Appendix II

# JOURNAL LIST

Journals from which articles have been abstracted and indexed in *NSA* are listed here alphabetically by title abbreviation.

The foreign language journals in this list available in English language translation are indicated and the title of the English language journal is included.

The title abbreviations are based on the National Clearinghouse for Periodical Title Word Abbreviations, *Word Abbreviation List* published by the Standards Committee Z-39 of the American National Standards Institute.

TID-4579-R7 *Serial Titles Cited in Nuclear Science Abstracts* lists the titles and abbreviations of the journals regularly scanned for *NSA* as well as those from which an occasional item is taken. This publication is available from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22151, in full size or microfiche copy.

## A

Accidents (London)
Accidents (London) (England)

Accounts Chem. Res.
Accounts of Chemical Research (U.S.)

Acta Agron. Acad. Sci. Hung.
Acta Agronomica Academiae Scientarum Hungaricae
(formerly carried as Acta Agron. (Budapest)) (Hungary)

Acta Astron.
Acta Astronomica, Polska Akademia Nauk (formed by Merger of
Acta Astronomica, Ser. A, Ser. B, and Ser. C) (Poland)

Acta Biochim. Biophys. (Budapest)
Acta Biochimica et Biophysica, Academiae Scientiarum
Hungaricae (Budapest) (Hungary)

Acta Biochim. Pol.
Acta Biochimica Polonica (Poland)

Acta Biol. Acad. Sci. Hung.
Acta Biologica Academiae Scientiarum Hungaricae (Hungary)

Acta Biol. Cracov., Ser. Zool.
Acta Biologica Cracoviensia, Serie Zoologie (Poland)

Acta Biol. Med. Ger.
Acta Biologica et Medica Germanica (East Germany)

Acta Chem. Fenn.
Acta CHemica Fennica (Finland)

Acta Chim. Acad. Sci. Hung.
Acta Chimica Academiae Scientiarum Hungaricae (Hungary)

Acta Cient. Compostelana
Acta Cientifica Compostelana (Spain)

Acta Cient. Venez.
Acta Cientifica Venezolana (Venezuela)

Acta Cient. Venez., Supl.
Acta Cientifica Venezolana, Suplemento (Venezuela)

Acta Crystallogr., Sect. A
Acta Crystallographica, Section A. Crystal Physics,
Diffraction, Theoretical and General Crystallography
(Continues in Part Acta Crystallographica) (Denmark)

Acta Crystallogr., Sect. B
Acta Crystallographica, Section B. Structural
Crystallography and Crystal Chemistry (Continues in Part
Acta Crystallographica) (Denmark)

Acta Electron.
Acta Electronica (France)

Acta Embryol. Exp.
Acta Embryologiae Experimentalis (Italy)
Supersedes Acta Embryol. Morphol. Exp.

Acta Endocrinol.
Acta Endocrinologica (Denmark)

Acta Fac. Med. Fluminensis
Acta Facultatis Medicae Fluminensis (Yugoslavia)

Acta Fac. Rerum Natur. Univ. Comenianae, Chim.
Acta Factultatis Rerum Naturalium Universitatis
Comenianae, Chimia (Czechoslovakia)

Acta Geophys. Pol.
Acta Geophysica Polonica (Poland)

Acta Gerontol.
Acta Gerontologica (Italy)

Acta Haematol.
Acta Haematologica. International Journal of Hematology
(Switzerland)

Acta Histochem.
Acta Histochemica (East Germany)

Acta Isotop.
Acta Isotopica (Italy)
Suspended publication with Vol. 11

Acta Mech.
Acta Mechanica (Austria - U.S.)

Acta Med. Acad. Sci. Hung.
Acta Medica Academiae Scientiarum Hungaricae (Hungary)

Acta Med. Scand.
Acta Medica Scandinavica (Sweden)

Acta Met.
Acta Metallurgica (U.S.)

Acta Morphol. Acad. Sci. Hung.
Acta Morphologica Academiae Scientiarum Hungaricae
(Hungary)

Acta Neuropathol.
Acta Neuropathologica (Germany)

Acta Odontol. Scand.
Acta Odontologica Scandinavica (Sweden)

Acta Oto-Laryngol.
Acta Oto-Laryngologica (Sweden)

Acta Pathol. Microbiol. Scand., Sect. B
Acta Pathologica et Microbiologica Scandinavica,
Section B. Microbiology and Immunology (Denmark)

Acta Pharm. Hung.
Acta Pharmaceutica Hungarica (Hungary)

Acta Pharm. Jugoslav.
Acta Pharmaceutica Jugoslavica (Yugoslavia)

Acta Phys. Acad. Sci. Hung.
Acta Physica Academiae Scientiarum Hungaricae (Hungary)

Acta Phys. Austr.
Acta Physica Austriaca (Austria)

Acta Phys. Austr., Suppl.
Acta Physica Austriaca, Supplementum (Austria)

Acta Physiol. Pol.
Acta Physiologica Polonica (Poland)

Acta Phys. Pol., A
Acta Physica Polonica, A (Poland)

Acta Phys. Pol., B
Acta Physica Polonica, B (Poland)

Acta Pol. Pharm.
Acta Poloniae Pharmaceutica (Poland)

Acta Polytech. Scand., Phys. Nucl. Ser.
Acta Polytechnica Scandinavica, Physics Including Nucleonics
Series (Finland)

Acta Radiol., Diagn.
Acta Radiologica, Diagnosis (Sweden)

Acta Radiol., Suppl.
Acta Radiologica, Supplementum (Sweden)

Acta Radiol., Ther., Phys., Biol.
Acta Radiologica, Therapy, Physics, Biology (Sweden)

Acta Soc. Bot. Pol.
Acta Societatis Botanicorum Poloniae (Poland)

Acta Tech. Acad. Sci. Hung.
Acta Technica Academiae Scientiarum Hungaricae (Hungary)

Acta Tech. CSAV
Acta Technica CSAV (Ceskoslovenska Akademie Ved) (Czechoslovakia)

Acta Univ. Szeged., Acta Phys. Chem.
Acta Universitatis Szegediensis, Acta Physica et Chemica (Hungary)

Acta Vet. (Brno)
Acta Veterinaria (Brno) (Czechoslovakia)

Acta Vet. Acad. Sci. Hung.
Acta Veterinaria Academiae Scientiarum Hungaricae (Hungary)

Acta Vet. Scand.
Acta Veterinaria Scandinavica (Denmark)

Acta Virol. (Prague) Engl. Ed.
Acta Virologica (Prague). An International Journal. English Edition (Czechoslovakia)

Advan. Cryog. Eng.
Advances in Cryogenic Engineering (U.S.)

Advan. Hydrosci.
Advances in Hydroscience (U.S.)

Advan. Instrum.
Advances in Instrumentation (U.S.)

Advan. Nucl. Phys.
Advances in Nuclear Physics (U. S.)

Advan. Nucl. Sci. Technol.
Advances in Nuclear Science and Technology (U.S.)

Advan. Phys.
Advances in Physics (England)

Advan. X-Ray Anal.
Advances in X-Ray Analysis (U.S.)

Aeronaut. Astronaut. (Paris)
Aeronautique et l'Astronautique (Formerly Technique et Science Aeronautiques et Spatiales) (France)

Aerotec.-Missili Spazio
Aerotecnica-Missili e Spazio (Italy)
Formed by merger of Aerotecnica and Missili e Spazio

Aerztl. Forsch.
Aerztliche Forschung (West Germany)
Discontinued

Agr. Biol. Chem. (Tokyo)
Agricultural and Biological Chemistry (Tokyo) (Japan)

Agrochemophysica
Agrochemophysica (South Africa)

Agrochimica
Agrochimica (Italy)

Agrokem. Talajtan
Agrokemia es Talajtan (Hungary)

Agrokhimiya
Agrokhimiya (U.S.S.R.)

Agron. Trop. (Paris)
Agronomie Tropicale (Paris) (France)

Agroplantae
Agroplantae (South Africa)

AIAA (Amer. Inst. Aeronaut. Astronaut.) J.
AIAA (American Institute of Aeronautics and Astronautics) Journal (Combining the ARS Journal and the Journal of Aerospace Science) (U.S.)

AIChE Monogr. Ser.
AIChE Monograph Series (U.S.)
Supersedes Chem. Eng. Progr., Monogr. Ser.

AIChE Symp. Ser.
AIChE Symposium Series (U.S.)
Supersedes Chem. Eng. Progr., Symp. Ser.

Aichi-Ken Eisei Kenkyusho-Ho
Aichi-Ken Eisei Kenkyusho-Ho (Report of Aichi Inst. of Public Health) (Japan)

AIP (Amer. Inst. Phys.) Conf. Proc.
AIP (American Institute of Physics) Conference Proceedings (U.S.)

Aircraft Eng.
Aircraft Engineering (England)

Akush. Ginekol.
Akusherstvo i Ginekologiya (U.S.S.R.)

Alluminio
Alluminio (Italy)

Allum. Nuova Met.
Alluminio e Nuova Metallurgia (Italy)

Alta Freq.
Alta Frequenza. Rivista di Radiotecnica, Telefonia e Acustica Applicata (Italy)

Amer. Ass. Petrol. Geol. Bull.
American Association of Petroleum Geologists Bulletin (U.S.)

Amer. Ceram. Soc. Bull.
American Ceramic Society Bulletin, The (U.S.)

Amer. Gas Ass. Mon.
American Gas Association Monthly (U.S.)

Amer. Ind. Hyg. Ass. J.
American Industrial Hygiene Association Journal (U.S.)

Amer. J. Anat.
American Journal of Anatomy, The (U.S.)

Amer. J. Bot.
American Journal of Botany (U.S.)

Amer. J. Epidemiol.
American Journal of Epidemiology (U.S.)

Amer. J. Hosp. Pharm.
American Journal of Hospital Pharmacy (U.S.)

Amer. J. Hum. Genet.
American Journal of Human Genetics (U.S.)

Amer. J. Med. Technol.
American Journal of Medical Technology (U.S.)

Amer. J. Obstet. Gynecol.
American Journal of Obstetrics and Gynecology (U.S.)

Amer. J. Phys.
American Journal of Physics (U.S.)

Amer. J. Phys. Anthropol.
American Journal of Physical Anthropology (U.S.)

Amer. J. Physiol.
American Journal of Physiology, The (U.S.)

Amer. J. Pub. Health
American Journal of Public Health (U.S.)

Amer. J. Roentgenol., Radium Ther. Nucl. Med.
American Journal of Roentgenology, Radium Therapy and Nuclear Medicine, The (U.S.)

Amer. J. Trop. Med. Hyg.
American Journal of Tropical Medicine and Hygiene (U.S.)

Amer. J. Vet. Res.
American Journal of Veterinary Research (U.S.)

Amer. Midland Natur.
American Midland Naturalist (U.S.)

Amer. Natur.
American Naturalist, The (U.S.)

Amer. Soc. Test. Mater., Spec. Tech. Publ.
American Society for Testing and Materials, Special Technical Publication (U. S.)

An. Acad. Brasil. Cienc.
Anais da Academia Brasileira de Ciencias (Brazil)

Anal. Biochem.
Analytical Biochemistry (U.S.)

Anal. Chem.
Analytical Chemistry (U.S.)

Anal. Chim. Acta
Analytica Chimica Acta (Netherlands)

Anal. Lett.
Analytical Letters (U.S.)

Analusis
Analusis (France)
Supersedes Chim. Anal. (Paris), and Method. Phys. Anal.

Analyst
Analyst, The (England)

An. Asoc. Quim. Argent.
Anales de la Asociacion Quimica Argentina (Argentina)

An. Fis.
Anales de Fisica. Real Sociedad Espanola de Fisica y Quimic
(Formerly Anales de la Real Sociedad Espanola de Fisica y
Quimica, Serie A. Fisica) (Spain)

Angew. Chem.
Angewandte Chemie (West Germany)

Angew. Chem. Int. Ed. Engl.
Angewandte Chemie. International Edition in English
(U.S.-West Germany)

Angew. Inform.
Angewandte Informatik (West Germany)
Supersedes Elektron. Datenverarb.

Ann. Acad. Sci. Fenn., Ser. A II
Annales Academiae Scientiarum Fennicae, Series A II.
Chemica (Finland)

Ann. Acad. Sci. Fenn., Ser. A VI
Annales Academiae Scientiarum Fennicae, Series A VI. Physic
(Finland)

Ann. Agron.
Annales Agronomiques (France)

Ann. Biol. Clin. (Paris)
Annales de Biologie Clinique (Paris) (France)

Ann. Chim. (Paris)
Annales de Chimie (Paris) (France)

Ann. Entomol. Soc. Amer.
Annals of the Entomological Society of America (U.S.)

Ann. Gembloux
Annales de Gembloux (Belgium)

Ann. Genet. (Paris)
Annales de Genetique (Paris) (France)

Ann. Geophys.
Annales de Geophysique (France)

Ann. Inst. Henri Poincare, Sect. A
Annales de l'Institut Henri Poincare, Section A. Physique
Theorique (France)

Ann. Inst. Tech. Batiment Trav. Publics
Annales de l'Institut Technique du Batiment et des
Travaux Publics (France)

Ann. Ist. Super. Sanita
Annali dell' Istituto Superiore di Sanita (Italy)

Ann. Mat. Pura Appl.
Annali di Matematica Pura ed Applicata (Italy)

Ann. Med. Exp. Biol. Fenn. (Helsinki)
Annales Medicinae Experimentalis et Biologiae Fenniae
(Helsinki) (Finland)

Ann. Mines
Annales des Mines (France)

Ann. N.Y. Acad. Sci.
Annals of the New York Academy of Sciences (U.S.)

Ann. Occup. Hyg.
Annals of Occupational Hygiene, The (England)

Ann. Otol., Rhinol., Laryngol.
Annals of Otology, Rhinology, and Laryngology (U.S.)

Ann. Pharm. (Poznan)
Annales Pharmaceutici (Poznan) (Poland)

Annot. Zool. Jap.
Annotationes Zoologicae Japonenses (Japan)

Ann. Phys. (Leipzig)
Annalen der Physik (Leipzig) (East Germany)

Ann. Phys. (N.Y.)
Annals of Physics (New York) (U.S.)

Ann. Phys. (Paris)
Annales de Physique (Paris) (France)

Ann. Phys. Biol. Med.
Annales de Physique Biologique et Medicale (France)

Ann. Rheum. Dis.
Annals of the Rheumatic Diseases (England)

Ann. Scu. Norm. Super. Pisa, Sci. Fis. Mat.
Annali della Scuola Normale Superiore di Pisa, Scienze
Fisiche e Matematiche (Italy)

Ann. Soc. Sci. Brux. Ser. I
Annales de la Societe Scientifique de Bruxelles. Serie I
(Belgium)

Ann. Surg.
Annals of Surgery (U.S.)

Ann. Telecommun.
Annales des Telecommunications (France)

Ann. Univ. Mariae Curie-Sklodowska, Lublin-Pol., Sect. AA
Annales Universitatis Mariae Curie-Sklodowska,
Lublin-Polonia, Sectio AA (Poland)

Ann. Univ. Sci. Budapest. Rolando Eotvos Nominatae, Sect.
Geol.
Annales Universitatis Scientiarum Budapestinensis de Rolando
Eotvos Nominatae, Sectio Geologica (Hungary)

Annu. Rev. Astron. Astrophys.
Annual Review of Astronomy and Astrophysics (U.S.)

Annu. Rev. Biochem.
Annual Review of Biochemistry (U.S.)

Annu. Rev. Biophys. Bioeng.
Annual Review of Biophysics and Bioengineering (U.S.)

Annu. Rev. Fluid Mech.
Annual Review of Fluid Mechanics (U. S.)

Annu. Rev. Nucl. Sci.
Annual Review of Nuclear Science (U.S.)

Annu. Rev. Phys. Chem.
Annual Review of Physical Chemistry (U.S.)

Ann. Zool.-Ecol. Anim.
Annales de Zoologie-Ecologie Animale (France)

An. Quim.
Anales de Quimica. Real Sociedad Espanola de Fisica y
Quimica (Formerly Anales de la Real Sociedad Espanola de
Fisica y Quimica, Serie B. Quimica) (Spain)

An. Stiint. Univ. Al. I. Cuza Iasi, Sect. Ib. Fiz.
Analele Stiintifice ale Universitatii Al. I. Cuza din Iasi,
Sectiunea Ib. Fizica (Romania)

Antarct. J. U. S.
Antarctic Journal of the United States (U.S.)

Antibiotiki
Antibiotiki (U.S.S.R.)

An. Univ. Bucuresti, Chim.
Analele Universitatii Bucuresti, Chimie (Romania)

An. Univ. Bucuresti, Fiz.
Analele Universitatii Bucuresti, Fizica (Romania)
Supersedes An. Univ. Bucuresti, Ser. Stiint. Natur., Fiz.

An. Univ. Bucuresti, Mat.-Mec.
Analele Universitatii Bucuresti, Matematica-
Mecanica (Romania)

Aomori Kenritsu Chuo Byoin Ishi
Aomori Kenritsu Chuo Byoin Ishi (Japan)

Apl. Mat.
Aplikace Matematiky (Czechoslovakia)

Appl. Microbiol.
Applied Microbiology (U.S.)

Appl. Opt.
Applied Optics (U.S.)

Appl. Phys.
Applied Physics (West Germany - U.S.)

Appl. Phys. Lett.
Applied Physics Letters (U.S.)

Appl. Sci. Res. (The Hague)
Applied Scientific Research (The Hague) (Netherlands)

Appl. Spectrosc.
Applied Spectroscopy (U.S.)

Appl. Spectrosc. Rev.
Applied Spectroscopy Reviews (U. S.)

Arbeitsmed. - Sozialmed. - Arbeitshyg.
Arbeitsmedizin - Sozialmedizin - Arbeitshygiene (West Germany)

Arbok Univ. Bergen, Mat.-Natur. Ser.
Arbok for Universitetet i Bergen, Matematisk-Naturvitenskapelig Serie (Norway)

Archaeometry
Archaeometry (England)

Arch. Belg. Dermatol. Syphiligr.
Archives Belges de Dermatologie et de Syphiligraphie (Belgium)

Arch. Biochem. Biophys.
Archives of Biochemistry and Biophysics (U.S.)

Arch. Biol. (Liege)
Archives de Biologie (Liege) (Belgium)

Arch. Dermatol. Forsch.
Archiv fuer Dermatologische Forschung (West Germany)
Supersedes Arch. Klin. Exp. Dermatol.

Arch. Eisenhuettenw.
Archiv fuer das Eisenhuettenwesen (West Germany)

Arch. Energiewirt.
Archiv fuer Energiewirtschaft (West Germany)

Arch. Environ. Health
Archives of Environmental Health (Formerly A.M.A. Archives of Industrial Health) (U.S.)

Arch. Gesam. Virusforsch.
Archiv fuer die Gesamte Virusforschung (Austria)

Arch. Gynaekol.
Archiv fuer Gynaekologie (West Germany)

Arch. Hutn.
Archiwum Hutnictwa (Poland)

Arch. Immunol. Ther. Exp.
Archivum Immunologiae et Therapiae Experimentalis (Poland)

Arch. Inst. Farmacol. Exp. (Madrid)
Archivos del Instituto de Farmacologia Experimental (Medicina) (Madrid) (Spain)

Arch. Int. Pharmacodyn.
Archives Internationales de Pharmacodynamie et de Therapie (Belgium)

Arch. Klin. Exp. Ohren-, Nasen- Kehlkopfheilk.
Archiv fuer Klinische und Experimentelle Ohren-, Nasen- und Kehlkopfheilkunde (West Germany)

Arch. Lebensmittelhyg.
Archiv fuer Lebensmittelhygiene Insbesondere fuer Fleisch, Fisch, und Milchhygiene (West Germany)

Arch. Mech. Stosow.
Archiwum Mechaniki Stosowanej (Poland)

Arch. Mikrobiol.
Archiv fuer Mikrobiologie (West Germany)

Arch. Oral Biol.
Archives of Oral Biology (England)

Arch. Otolaryngol.
Archives of Otolaryngology (U.S.)

Arch. Pathol.
Archives of Pathology (Formerly A.M.A. Archives of Pathology) (U.S.)

Arch. Ration. Mech. Anal.
Archive for Rational Mechanics and Analysis (West Germany)

Arch. Tech. Mes.
Archiv fuer Technisches Messen und Industrielle Messtechnik (West Germany)
Superseded by Arch. Tech. Mes. Messtech. Praxis

Arch. Tierernaehr.
Archiv fuer Tierernaehrung (East Germany)

Ark. Fys. Seminar Trondheim
Arkiv for det Fysiske Seminar i Trondheim (Norway)

Arkh. Anat., Gistol. Embriol.
Arkhiv Anatomii, Gistologii i Embriologii (U.S.S.R.)

Arkh. Patol.
Arkhiv Patologii (U.S.S.R.)

Arm. Khim. Zh.
Armyanskii Khimicheskii Zhurnal (Formerly Izvestiya Akademii Nauk Armyanskoi SSR, Khimicheskie Nauk) (Armenian S.S.R.)

Arzneim.-Forsch.
Arzneimittel-Forschung. Drug Research (West Germany)

Asahi Garasu Kenkyu Hokoku
Asahi Garasu Kenkyu Hokoku (Reports of the Research Lab., Asahi Glass Co.) (Japan)

ASHRAE (Amer. Soc. Heat., Refrig. Air-Cond. Eng.) J.
ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Journal (U.S.)

Astron. Astrophys.
Astronomy and Astrophysics (Formed by the Merging of Annales d'Astrophysique, Bulletin of the Astronomical Institutes of the Netherlands, Bulletin Astronomique, Journal des Observateurs, and Zeitschrift fuer Astrophysik) (West Germany - U.S.)

Astron. Astrophys., Suppl. Ser.
Astronomy and Astrophysics, Supplement Series (Switzerland)

Astronaut. Aeronaut.
Astronautics and Aeronautics (Formerly Astronautics and Aerospace Engineering) (U.S.)

Astron. J.
Astronomical Journal, The (U.S.)

Astronomie
Astronomie, L (France)

Astron. Tidsskr.
Astronomisk Tidsskrift (Norway)

Astrophysics (Engl. Transl.)
Astrophysics (English Translation of Astrofizika) (U.S.)

Astrophys. J.
Astrophysical Journal, The (U.S.)

Astrophys. J., Suppl. Ser.
Astrophysical Journal, The, Supplement Series (U.S.)

Astrophys. Lett.
Astrophysical Letters (Scotland)

Astrophys. Space Sci.
Astrophysics and Space Science (Netherlands)

Astrophys. Space Sci. Libr.
Astrophysics and Space Science Library (Netherlands)

At. Energ. (USSR)
Atomnaya Energiya (U.S.S.R.)
Issued in English Translation as Soviet Journal of Atomic Energy, The

At. Energy Aust.
Atomic Energy in Australia (Australia)

At. Energy Rev.
Atomic Energy Review (Austria)

ATF Colada
ATF Colada (Spain)

At. Inform.
Atom Information (West Germany)

At. Jap.
Atoms in Japan (Japan)

At. Jap., Suppl.
Atoms in Japan, Supplement (Japan)

Atmos. Environ.
Atmospheric Environment (England)

Atom (London)
Atom (London) (England)

Atomkernenergie
Atomkernenergie (Formerly Atomenergie) (West Germany)

ATOMKI (At. Kut. Intez.) Kozlem.
ATOMKI (Atommag Kutato Intezet) Kozlemenyek (Hungary)

Atomwirt., Atomtech.
Atomwirtschaft, Atomtechnik
(Formerly Atomwirtschaft, Die) (West Germany)

Atoomenergie Haar Toepass.
Atoomenergie en Haar Toepassingen (Formerly RCN Bulletin)
(Netherlands)

At. Strom
Atom und Strom (West Germany)

Atti Accad. Naz. Lincei, Rend., Cl. Sci. Fis., Mat. Natur.
Atti della Accademia Nazionale dei Lincei, Rendiconti,
Classe di Scienze Fisiche, Matematiche e Naturali (Italy)

Atti Notiz. (Publ. in Met. Ital.)
Atti Notizie, Associazione Italiana di Metallurgia
(Published in Metallurgia Italiana) (Italy)

Aufbereit.-Tech.
Aufbereitungs-Technik (West Germany)

Aussenpolitik
Aussenpolitik (West Germany)

Aust., Bur. Miner. Resour., Geol. Geophys., Bull.
Australia, Bureau of Mineral Resources, Geology and
Geophysics, Bulletin (Australia)

Aust. Comput. J.
Australian Computer Journal, The (Australia)

Aust. J. Chem.
Australian Journal of Chemistry (Australia)

Aust. J. Phys.
Australian Journal of Physics (Australia)

Aust. J. Phys., Astrophys. Suppl.
Australian Journal of Physics, Astrophysical Supplement
(Australia)

Aust. J. Soil Res.
Australian Journal of Soil Research (Australia)

Aust. Mining
Australian Mining (Australia)

Australas. Mfg. Eng.
Australasian Manufacturing Engineer incorporating
Machine Shop (Australia)

Australas. Radiol.
Australasian Radiology (Formerly Journal of the College of
Radiologists of Australasia) (Australia)

Aust. Weld. J.
Australian Welding Journal (Australia)

Aust. Weld. Res.
Australian Welding Research (Australia)

Automatica
Automatica (England - U.S.)

Automat. Weld. (USSR) (Engl. Transl.)
Automatic Welding (USSR) (English Translation of
Avtomaticheskaya Svarka) (U.S.)

Avtomatika
Avtomatika (Ukrainian S.S.R.)
Issued in English translation as Sov. Automat. Contr.

Avtomat. Svarka
Avtomaticheskaya Svarka (Ukrainian S.S.R.)
Issued in English Translation as Automatic Welding (USSR)

Azerb. Khim. Zh.
Azerbaidzhanskii Khimicheskii Zhurnal (Azerbaidzhan S.S.R.)

Bacteriol. Rev.
Bacteriological Reviews (U.S.)

Baender, Bleche, Rohre
Baender, Bleche, Rohre (West Germany)

Banyasz. Kohasz. Lapok, Kohasz.
Banyaszati es Kohaszati Lapok, Kohaszat (Hungary)
Supersedes Kohasz. Lapok

Banyasz. Kut. Intez. Kozlem.
Banyaszati Kutato Intezet Kozlemenyei (Hungary)

Bauingenieur
Bauingenieur (West Germany)

BBC-Nachr.
BBC-Nachrichten (Switzerland)

Beitr. Pathol.
Beitraege zur Pathologie (West Germany)
Supersedes Beitraege zur Pathologischen Anatomie und zur
Allgemeinen Pathologie

Beitr. Plasmaphys.
Beitraege aus der Plasmaphysik (East Germany)

Ber. Bunsenges. Phys. Chem.
Berichte der Bunsengesellschaft fuer Physikalische Chemie
(Formerly Zeitschrift fuer Elektrochemie) (West Germany)

Ber. Deut. Keram. Ges.
Berichte der Deutschen Keramischen Gesellschaft E. V.
(West Germany)

Berg- Huettenmaenn. Monatsh.
Berg- und Huettenmaennische Monatshefte (Austria)

Ber. Landwirt.
Bericht ueber Landwirtschaft (West Germany)

Bild Wiss.
Bild der Wissenschaft (West Germany)

Biochem. Biophys. Res. Commun.
Biochemical and Biophysical Research Communications (U.S.)

Biochem. Genet.
Biochemical Genetics (U.S.)

Biochemistry
Biochemistry (U.S.)

Biochem. J.
Biochemical Journal (England)

Biochem. Pharmacol.
Biochemical Pharmacology (England)

Biochim. Biophys. Acta
Biochimica et Biophysica Acta (Netherlands)

Biofizika
Biofizika (U.S.S.R.)
For English Translation see Biophysics (USSR)

Biol. Bull.
Biological Bulletin, The (U.S.)

Biol. Nauki
Biologicheskie Nauki (U.S.S.R.)

Biologia (Bratislava)
Biologia (Bratislava) (Czechoslovakia)

Biol. Plant. (Prague)
Biologia Plantarum (Prague) (Czechoslovakia)

Biol. Reprod.
Biology of Reproduction (U. S.)

Biol. Rev. Cambridge Phil. Soc.
Biological Reviews of the Cambridge Philosophical Society
(England)

Biol. Zh. Arm.
Biologicheskii Zhurnal Armenii (Formerly Izvestiya Akademii
Nauk Armyanskoi SSR, Biologicheskie Nauki) (Armenian
S.S.R.)

Bio-Med. Eng.
Bio-Medical Engineering (England)

Biophysik
Biophysik (West Germany)

Biophys. J.
Biophysical Journal (U.S.)

Bioscience
Bioscience (U.S.)

Bldg. Sci.
Building Science (England - U.S.)

Blood
Blood. The Journal of Hematology (U.S.)

Blut
Blut. Zeitschrift fuer Gesamte Blutforschung
(West Germany)

Bol. Inst. Mat., Astron. Fis.
Boletin del Instituto de Matematica, Astronomia y Fisica
(Argentina)

Boll. Soc. Ital. Biol. Sper.
Bollettino della Societa Italiana di Biologia Sperimentale (Italy)

Boll. Soc. Natur. Napoli
Bollettino della Societa dei Naturalisti in Napoli (Italy)

Bot. Gaz. (Chicago)
Botanical Gazette, The (Chicago) (U. S.)

Brandschutz
Brandschutz (West Germany)

Bratislav. Lek. Listy
Bratislavske Lekarske Listy (Czechoslovakia)

Braunkohle
Braunkohle. Waerme und Energie. Zeitschrift fuer Gewinnung und Verwertung der Brauhkohle (West Germany)

Brennst.-Waerme-Kraft
Brennstoff-Waerme-Kraft (West Germany)

Brit. J. Anaesth.
British Journal of Anaesthesia (England)

Brit. J. Cancer
British Journal of Cancer (England)

Brit. J. Clin. Pract.
British Journal of Clinical Practice, Incorporating Medicine Illustrated (England)

Brit. J. Dermatol.
British Journal of Dermatology (England)

Brit. J. Exp. Pathol.
British Journal of Experimental Pathology (England)

Brit. J. Non-Destruct. Test.
British Journal of Non-Destructive Testing (England)

Brit. J. Radiol.
British Journal of Radiology (England)

Brit. Med. Bull.
British Medical Bulletin (England)

Brit. Med. J.
British Medical Journal, The (England)

Bruns Beitr. Klin. Chir.
Bruns Beitraege zur Klinischen Chirurgie (West Germany)

Bruxelles-Med.
Bruxelles-Medical (Belgium)

Bul. Inst. Politeh. Gheorghe Gheorghiu-Dej Bucuresti
Buletinul Institutului Politehnic Gheorghe Gheorghiu-Dej Bucuresti (Romania)

Bull. Acad. Nat. Med. (Paris)
Bulletin de l'Academie Nationale de Medecine (Paris)

Bull. Acad. Pol. Sci., Ser. Sci. Biol.
Bulletin de l'Academie Polonaise des Sciences, Serie des Sciences Biologiques (Poland)

Bull. Acad. Pol. Sci., Ser. Sci. Chim.
Bulletin de l'Academie Polonaise des Sciences, Serie des Sciences Chimiques (Poland)

Bull. Acad. Pol. Sci., Ser. Sci., Math., Astron. Phys.
Bulletin de l'Academie Polonaise des Sciences, Serie des Sciences, Mathematiques, Astronomiques et Physiques (Poland)

Bull. Acad. Pol. Sci., Ser. Sci. Tech.
Bulletin de l'Academie Polonaise des Sciences, Serie des Sciences Techniques (Poland)

Bull. Ass. Tech. Mar. Aeronaut.
Bulletin de l'Association Technique Maritime et Aeronautique (France)

Bull. Astron. Inst. Czech.
Bulletin of the Astronomical Institutes of Czechoslovakia (Czechoslovakia)

Bull. Aust. Math. Soc.
Bulletin of the Australian Mathematical Society (Australia)

Bull. Boris Kidric Inst. Nucl. Sci., Nucl. Eng.
Bulletin of the Boris Kidric Institute of Nuclear Sciences, Nuclear Engineering (Yugoslavia)

Bull. Chem. Soc. Jap.
Bulletin of the Chemical Society of Japan (Japan)

Bull. Cl. Sci., Acad. Roy. Belg.
Bulletin de la Classe des Sciences, Academie Royale de Belgique (Belgium)

Bull. Dir. Etud. Rech., Ser. A
Bulletin de la Direction des Etudes et Recherches, Serie A (France)

Bull. Droit Nucl.
Bulletin de Droit Nucleaire (France)

Bull. Environ. Contam. Toxicol.
Bulletin of Environmental Contamination and Toxicology (U.S.-West Germany)

Bull. Ga. Acad. Sci.
Bulletin of the Georgia Academy of Science (U.S.)

Bull. Inform. A.T.E.N. (Ass. Tech. Energ. Nucl.)
Bulletin d'Information A.T.E.N. (Association Technique pour l'Energie Nucleaire) (France)

Bull. Inform. A.T.E.N. (Ass. Tech. Energ. Nucl.), Suppl.
Bulletin d'Information A.T.E.N. (Association Technique pour l'Energie Nucleaire), Supplement (France)

Bull. Inform. Sci. Tech. (Paris)
Bulletin d'Information Scientifique et Technique (Paris) (France)

Bull. Inst. Chem. Res., Kyoto Univ.
Bulletin of the Institute for Chemical Research, Kyoto University (Japan)

Bull. JSME (Jap. Soc. Mech. Eng.)
Bulletin of JSME (Japan Society of Mechanical Engineers) (Japan)

Bull. Los Angeles Neurol. Soc.
Bulletin of the Los Angeles Neurological Society (U.S.)

Bull. Math.
Bulletin Mathematique (Romania)

Bull. Oil Natur. Gas Comm.
Bulletin of the Oil and Natural Gas Commission (India)

Bull. Ophthalmol. Soc. Egypt
Bulletin of the Ophthalmological Society of Egypt (Egypt)

Bull. Seismol. Soc. Amer.
Bulletin of the Seismological Society of America (U.S.)

Bull. Slov. Pol'nohospod. Akad., Vysk. Ustavu Potravin.
Bulletin Slovenskej Pol'nohospodarskej Akademie, Vyskumneho Ustavu Potravinarskeho (Czechoslovakia)

Bull. Soc. Chim. Belg.
Bulletin des Societes Chimiques Belges (Belgium)

Bull. Soc. Chim. Beograd
Bulletin de la Societe Chimique Beograd (Formerly carried under title: Glasnik Hemiskog Drustva, Beograd) (Yugoslavia)

Bull. Soc. Chim. Fr.
Bulletin de la Societe Chimique de France (France)

Bull. Soc. Fr. Ceram.
Bulletin de la Societe Francaise de Ceramique (France)

Bull. Soc. Fr. Miner. Crist.
Bulletin de la Societe Francaise de Mineralogie et de Cristallographie (France)

Bull. Soc. Pharm. Bordeaux
Bulletin de la Societe de Pharmacie de Bordeaux (France)

Bull. Soc. Roy. Sci. Liege
Bulletin de la Societe Royale des Sciences de Liege (Belgium)

Bull. Tokyo Gakugei Univ., Ser. 4
Bulletin of the Tokyo Gakugei University, Series 4 (Japan)

Bull. Tokyo Inst. Technol. (Engl. Ed.)
Bulletin of the Tokyo Institute of Technology (English Edition) (Not the same publication as Tokyo Kogyo Daigaku Gakuho) (Japan)

Bundesgesundheitsblatt
Bundesgesundheitsblatt (West Germany)

Bunseki Kiki
Bunseki Kiki (Analytical Instruments) (Japan)

Bygg
Bygg (Norway)

Byull., Abastumanskaya Astrofiz. Observ., Akad. Nauk Gruz. SSR
Byulleten, Abastumanskaya Astrofizicheskaya Observatoriya, Akademiya Nauk Gruzinskoi SSR (Georgian S.S.R.)

Byull. Eksp. Biol. Med.
Byulleten Eksperimental'noi Biologii i Meditsiny (U.S.S.R.) For English Translation see Bulletin of Experimental Biology and Medicine (USSR)

# C

Cah. Med. (Paris)
Cahiers de Medecine (Paris) (France)
Supersedes Cah. Coll. Med.

Cah. Med. Interprof.
Cahiers de Medecine Interprofessionnelle (France)

Californium-252 Progr.
Californium-252 Progress (U. S.)

Calore
Calore, Il (Italy)

CAMAC Bull.
CAMAC Bulletin (Luxembourg)

Cancer
Cancer (U.S.)

Cancer Res.
Cancer Research (U.S.)

Can. Chem. Process.
Canadian Chemical Processing (Canada)

Can. Electron. Eng.
Canadian Electronics Engineering (Canada)

Can. Entomol.
Canadian Entomologist, The (Canada)

Can. Geotech. J.
Canadian Geotechnical Journal (Canada)

Can. J. Bot.
Canadian Journal of Botany (Canada)

Can. J. Chem.
Canadian Journal of Chemistry (Canada)

Can. J. Chem. Eng.
Canadian Journal of Chemical Engineering (Formerly Canadian Journal of Technology) (Canada)

Can. J. Earth Sci.
Canadian Journal of Earth Sciences (Canada)

Can. J. Genet. Cytol.
Canadian Journal of Genetics and Cytology (Canada)

Can. J. Phys.
Canadian Journal of Physics (Canada)

Can. J. Physiol. Pharmacol.
Canadian Journal of Physiology and Pharmacology (Supersedes in Part Canadian Journal of Biochemistry and Physiology) (Canada)

Can. J. Plant Sci.
Canadian Journal of Plant Science (Canada)

Can. J. Spectrosc.
Canadian Journal of Spectroscopy (Canada)
Supersedes Can. Spectrosc.

Can. J. Zool.
Canadian Journal of Zoology (Canada)

Can. Med. Ass. J.
Canadian Medical Association Journal, The (Canada)

Can. Met. Quart.
Canadian Metallurgical Quarterly (Canada)

Can. Res. Develop.
Canadian Research and Development (Formerly Canadian Nuclear Technology) (Canada)

Can. Text. J.
Canadian Textile Journal (Canada)

Can. Welder Fabr.
Canadian Welder and Fabricator (Canada)

Carbon
Carbon (England)

Cardiologia
Cardiologia (Switzerland)
Changed to Cardiology

Caries Res.
Caries Research (Switzerland)

Caryologia
Caryologia (Italy)

Case Stud. At. Phys.
Case Studies in Atomic Physics (Netherlands)

Cas. Lek. Cesk.
Casopis Lekaru Ceskych (Czechoslovakia)

Cas. Mineral. Geol.
Casopis pro Mineralogii a Geologii (Czechoslovakia)

Catal. Environ. Qual.
Catalyst for Environmental Quality (U.S.)

Celestial Mech.
Celestial Mechanics (Netherlands)

Cell. Immunol.
Cellular Immunology (U.S.)

Cell Tissue Kinet.
Cell and Tissue Kinetics (England)

Cercet. Met.
Cercetari Metalurgice (Romania)

CERN Cour.
CERN Courier (Switzerland)

Cesk. Cas. Fys.
Ceskoslovensky Casopis pro Fysiku (Czechoslovakia)

Cesk. Gastroenterol. Vyz.
Ceskoslovenska Gastroenterologie a Vyziva, Sbornik pro Pathofysiologii Traveni a Vyzivy (Czechoslovakia)

Cesk. Hyg.
Ceskoslovenska Hygiena (Czechoslovakia)

Cesk. Oftalmol.
Ceskoslovenska Oftalmologie (Czechoslovakia)

Cesk. Radiol.
Ceskoslovenska Radiologie (Formerly Ceskoslovenska Rentgenologie) (Czechoslovakia)

Cesk. Stomatol.
Ceskoslovenska Stomatologie (Czechoslovakia)

Chem. Anal. (Warsaw)
Chemia Analityczna (Warsaw) (Poland)

Chem.-Anlagen Verfahren
Chemie-Anlagen und Verfahren (West Germany)

Chem. Ber.
Chemische Berichte (West Germany)

Chem. Brit.
Chemistry in Britain (England)

Chem. Eng. (London)
Chemical Engineer, The (London) Includes Transaction of the Institution of Chemical Engineers (London) (England)

Chem. Eng. (N.Y.)
Chemical Engineering (New York) (U.S.)

Chem. Eng. Progr.
Chemical Engineering Progress (U.S.)

Chem. Eng. Progr., Symp. Ser.
Chemical Engineering Progress, Symposium Series (U.S.)
Changed to AIChE Symp. Ser.

Chem. Eng. Sci.
Chemical Engineering Science (England)

Chem. Geol.
Chemical Geology (Netherlands)

Chem. Ind. (London)
Chemistry and Industry (London) (England)

Chem.-Ing.-Tech.
Chemie-Ingenieur-Technik (West Germany)

Chem. Instrum.
Chemical Instrumentation (U.S.)

Chem. Listy
Chemicke Listy (Czechoslovakia)

Chem. Pharm. Bull. (Tokyo)
Chemical and Pharmaceutical Bulletin (Tokyo) (Japan)

Chem. Phys. Lett.
Chemical Physics Letters (Netherlands)

Chem. Phys. Lipids
Chemistry and Physics of Lipids (Netherlands)

Chem. Prumysl
Chemicky Prumysl (Czechoslovakia)

Chem. Scr.
Chemica Scripta (Sweden)
Supersedes Arkiv for Kemi

Chem. Technol.
Chemical Technology (U.S.)
Supersedes Ind. Eng. Chem.

Chem. Ztg.
Chemiker Zeitung (West Germany)
Superseded by Chem.-Ztg., Chem. App.; changed
back to Chem.-Ztg.

Chem.-Ztg., Chem. App.
Chemiker-Zeitung, Chemische Apparatur (West Germany)
Formerly Chem.-Ztg.; changed back to Chem.-Ztg.

Chem. Zvesti
Chemicke Zvesti (Czechoslovakia)

Chest (Chicago)
Chest (Chicago) (U. S.)
Supersedes Diseases of the Chest

Chim. Anal. (Bucharest)
Chimie Analitica (Bucharest) (Supplement to Rev. Chim.)
(Romania)

Chimia (Aarau)
Chimia (Aarau) (Switzerland)

Chim. Ind. (Milan)
Chimica e l'Industria, La (Milan) (Italy)

Chim. Ind., Genie Chim.
Chimie et Industrie, Genie Chimique (Formed by the Merger of
Chimie et Industrie (Paris) and Genie Chimique (Paris))
(France)

Chim. Ther.
Chimie Therapeutique (France)

Chin. J. Phys. (Taiwan)
Chinese Journal of Physics (Taiwan) (China)

Chishitsu Chosajo Hokoku
Chishitsu Chosajo Hokoku (Report, Geological Survey of
Japan) (Japan)

Chishitsu Chosasho Geppo
Chishitsu Chosasho Geppo (Bulletin of the Geological Survey
of Japan) (Japan)

Chishitsugaku Zasshi
Chishitsugaku Zasshi (Journal of the Geological Society of
Japan) (Japan)

Cho-Koon Kenkyu
Cho-Koon Kenkyu (Japan)

Chromatographia
Chromatographia (West Germany)

Chromosoma
Chromosoma (West Germany)

Chron. Chim.
Chronache di Chimica (Italy)

Chutanzo
Chutanzo (Casting and Forging) (Japan)

Circulation Res.
Circulation Research. An Official Journal of the American
Heart Association (U.S.)

Civil Eng. (N. Y.)
Civil Engineering (New York) (U.S.)

Civil Eng. Public Works Rev.
Civil Engineering and Public Works Review (England)

Clin, Chim. Acta
Clinica Chimica Acta (Netherlands)

Clin. Radiol.
Clinical Radiology (Scotland)

Clin. Ter.
Clinica Terapeutica (Italy)

Cluj. Med.
Clujul Medical (Romania)

Cobalt
Cobalt (Belgium)

Collect. Czech. Chem. Commun.
Collection of Czechoslovak Chemical Communications
(Czechoslovakia)

Colloq. Int. Cent. Nat. Rech. Sci.
Colloques Internationaux du Centre National de la Recherche
Scientifique (France)

Combustion
Combustion (U.S.)

Commentat. Phys.-Math.
Commentationes Physico-Mathematicae (Finland)

Comments Astrophys. Space Phys.
Comments on Astrophysics and Space Physics
(England - U. S.)

Comments At. Mol. Phys.
Comments on Atomic and Molecular Physics
(England - U. S.)

Comments Earth Sci., Geophys.
Comments on Earth Sciences, Geophysics (England)

Comments Nucl. Particle Phys.
Comments on Nuclear and Particle Physics
(England - U. S.)

Comments Solid State Phys.
Comments on Solid State Physics (England - U. S.)

Commun. Math. Phys.
Communications in Mathematical Physics (West Germany)

Commun. Pure Appl. Math.
Communications on Pure and Applied Mathematics (U.S.)

Com. Naz. Energ. Nucl., Notiz.
Comitato Nazionale per l'Energia Nucleare, Notiziario
(Italy)

Comp. Biochem. Physiol., B
Comparative Biochemistry and Physiology, B. Comparative
Biochemistry (England)
Continues in part Comp. Biochem. Physiol.

Composites
Composites (England)

Compt. Rend., Ser. A, B
Comptes Rendus Hebdomadaires des Seances de l'Academie des
Sciences, Series A, et B (France

Compt. Rend., Ser. C
Comptes Rendus Hebdomadaires des Seances de l'Academie des
Sciences, Serie C (France)

Compt. Rend., Ser. D
Comptes Rendus Hebdomadaires des Seances de l'Academie des
Sciences, Serie D (France)

Compt. Rend. Acad. Bulg. Sci.
Comptes Rendus de l'Academie Bulgare des Sciences
(Bulgaria)

Compt. Rend. Hebd. Seances Acad. Agr. Fr.
Comptes Rendus Hebdomadaires des Seances de
l'Academie d'Agriculture de France (France)

Compt. Rend. Soc. Biol.
Comptes Rendus des Seances de la Societe de Biologie et
de ses Filiales (France)

Comput. Biol. Med.
Computers in Biology and Medicine (U.S.)

Computing
Computing (Austria)

Comput. Phys. Commun.
Computer Physics Communications (Netherlands)

Comput. Phys. Commun., Suppl.
Computer Physics Communications, Supplement (Netherlands)

Comput. Struct.
Computers and Structures (England)

Conf. Remote Syst. Technol., Proc.
Conference on Remote Systems Technology, Proceedings (U.S.)

Confructa
Confructa (West Germany)

Constr. Masini
Constructia de Masini (Romania)

Contemp. Phys.
Contemporary Physics (England)

Continental Paint Resin News
Continental Paint and Resin News (England)

Contr. Instrum.
Control and Instrumentation (Formerly Control and
Automation Process) (England)

Contr. Syst.
Control Systems (Australia)

Copper (Geneva)
Copper (Geneva) (Incorporating Copper Abstracts)
(Switzerland)

Corrosion
Corrosion (U.S.)

Corros. Sci.
Corrosion Science (England)

Cor Vasa
Cor et Vasa (Czechoslovakia)

Cosmic Electrodyn.
Cosmic Electrodynamics (Netherlands)

Cosmic Res. (USSR) (Engl. Transl.)
Cosmic Research (USSR) (English Translation of Kosmicheskie
Issledovaniya) (U.S.)

Cost Eng. (Dover, N. H.)
Cost Engineering (Dover, N. H.) (U.S.)

CRC Crit. Rev. Environ. Contr.
CRC Critical Reviews in Environmental Control (U. S.)

CRC Crit. Rev. Solid State Sci.
CRC Critical Reviews in Solid State Sciences (U. S.)

Croat. Chem. Acta
Croatica Chemica Acta (Yugoslavia)

Crop Sci.
Crop Science (U.S.)

Cryogenics
Cryogenics (England)

Cryog. Ind. Gases
Cryogenic and Industrial Gases (formerly Cryogenic
Engineering News) (U.S.)

Cryst. Lattice Defects
Crystal Lattice Defects (Northern Ireland)

Curr. Sci. (India)
Current Science (India)

Curr. Top. Radiat. Res. Quart.
Current Topics in Radiation Research Quarterly (Netherlands)
Supersedes Curr. Top. Radiat. Res.

Cytologia (Tokyo)
Cytologia (Tokyo) International Journal of Cytology (Japan)

Czech. J. Phys.
Czechoslovak Journal of Physics (Czechoslovakia)

## D

Daehan Hwahak Hwoejee
Daehan Hwahak Hwoejee (Journal of the Korean Chemical
Society) (South Korea)

Dan. Med. Bull.
Danish Medical Bulletin (Denmark)

Dechema Monogr.
Dechema Monographien (West Germany)

Defazet-Aktuell
Defazet-Aktuell (West Germany)

Defektoskopiya
Defektoskopiya (U.S.S.R.)
Issued in English translation as Soviet Journal of
Nondestructive Testing

Def. Sci. J. (New Delhi)
Defence Science Journal (New Delhi) (India)

Delft Progr. Rep., Ser. A-F
Delft Progress Report, Series A - F (Netherlands)

Denki Gakkai Ronbunshi, A
Denki Gakkai Ronbunshi, A (Japan)

Denki Kagaku
Denki Kagaku (Journal of the Electrochemical Society of
Japan) (Japan)
Changed to Denki Kagaku Oyobi Kogyo Butsuri Kagaku

Denki Shikensho Iho
Denki Shikensho Iho (Bulletin of the Electrotechnical
Laboratory (Tokyo)) (Japan)

Denshi Gijutsu Sogo Kenkyusho Iho
Denshi Gijutsu Sogo Kenkyusho Iho (Japan)

Denshi Tenbo
Denshi Tenbo (Electronics Review) (Japan)

Dermatologica
Dermatologica (Switzerland)

Deut. Forschungsdienst, Sonderber. Kernenerg.
Deutscher Forschungsdienst, Sonderbericht Kernenergie
(West Germany)

Deut. Gesundheitsw.
Deutsche Gesundheitswesen, Das (West Germany)

Deut. Lebensm.-Rundsch.
Deutsche Lebensmittel-Rundschau (West Germany)

Deut. Zahnaertztl. Z.
Deutsche Zahnaerztliche Zeitschrift (East Germany)

Develop. Appl. Spectrosc.
Developments in Applied Spectroscopy (U. S.)

Develop. Biol.
Developmental Biology (U.S.)

Develop. Ind. Sci.
Developpement Industriel et Scientifique (France)

Develop. Psychobiol.
Developmental Psychobiology (U. S.)

Dew Tech. Ber.
Dew Technische Berichte (West Germany)

Diffus. Data
Diffusion Data (U.S.)

Dis. Colon Rectum
Diseases of the Colon and Rectum (U.S.)

Discuss. Faraday Soc.
Discussions of the Faraday Society (England)

Doboku Gakkai Ronbun Hokokushu
Doboku Gakkai Ronbun Hokokushu (Japan)

Doboku Gakkaishi
Doboku Gakkaishi (Journal of the Japan Society of Civil
Engineers) (Japan)

Doboku Seko
Doboku Seko (Public Works) (Japan)

Dobutsugaku Zasshi
Dobutsugaku Zasshi (Zoological Magazine) (Japan)

Dock Harbour Auth.
Dock and Harbour Authority, The (England)

Dokl. Akad. Nauk Arm. SSR
Doklady Akademii Nauk Armyanskoi SSR (Armenian S.S.R.)

Dokl. Akad. Nauk Azerb. SSR
Doklady Akademii Nauk Azerbaidzhanskoi SSR
(Azerbaidzhan S.S.R.)

Dokl. Akad. Nauk BSSR
Doklady Akademii Nauk BSSR (Belorussian S.S.R.)

Dokl. Akad. Nauk SSSR
Doklady Akademii Nauk SSSR (U.S.S.R.)
Issued in English Translation by Sections

Dokl. Akad. Nauk Tadzh. SSR
Doklady Akademii Nauk Tadzhikskoi SSR (Tadzhik S.S.R.)

Dokl. Akad. Nauk Uzb. SSR
Doklady Akademii Nauk Uzbekskoi SSR (Uzbek S.S.R.)

Dopov. Akad. Nauk Ukr. RSR, Ser. A
Dopovidi Akademii Nauk Ukrains'koi RSR, Seriya A
Fiziko-Tekhnichni ta Matematichni Nauki (Supersedes in Part
Dopovidi Akademii Nauk Ukrains'koi RSR) (Ukrainian S.S.R.)

Dopov. Akad. Nauk Ukr. RSR, Ser. B
Dopovidi Akademii Nauk Ukrains'koi RSR, Seriya B
Geologiia, Geofizika, Khimiya na Biologiya (Supersedes In
Part Dopovidi Akademii Nauk Ukrains'koi RSR)
(Ukrainian S.S.R.)

Doryokuro Giho
Doryokuro Giho (Japan)

Draht
Draht (West Germany)

Duodecim
Duodecim (Finland)

# E

Earth Extraterr. Sci.
Earth and Extraterrestrial Sciences (England)

Earth Planet. Sci. Lett.
Earth and Planetary Science Letters (Netherlands)

Ecology
Ecology (U.S.)

Econ. Geol.
Economic Geology and the Bulletin of the Society of Economic
Geologists (U.S.)

Egeszsegtudomany
Egeszsegtudomany (Hungary)

Egypt. J. Genet. Cytol.
Egyptian Journal of Genetics and Cytology (Egypt)

Ebara Jiho
Ebara Jiho (Ebara Times) (Japan)

Ehime Daigaku Kiyo, Dai-3-Bu, Kogaku
Ehime Daigaku Kiyo, Dai-3-Bu, Kogaku (Memoirs of the Ehime
University, Section 3, Engineering) (Japan)

Eisei Kagaku
Eisei Kagaku (The Journal of Hygienic Chemistry) (Japan)

Ekologiya
Ekologiya (U.S.S.R.)

ELDO/ESRO Sci. Tech. Rev.
ELDO/ESRO Scientific and Technical Review (France)

Elec.-Electron. Mod.
Electricite-Electronique Moderne (France)

Elec. Light Power (Boston)
Electric Light and Power (Boston) (U.S.)
Superseded by Elec. Light Power, E/G Ed. and Elec.
Light Power, T/D Ed.

Elec. News Eng.
Electrical News and Engineering (Canada)

Elec. Rev.
Electrical Review (England)

Electricite
Electricite (Belgium)

Electrochim. Acta
Electrochimica Acta (England)

Electroencephalogr. Clin. Neurophysiol.
Electroencephalography and Clinical Neurophysiology
(Netherlands)

Electromedica
Electromedica (West Germany)

Electron. Lett.
Electronics Letters (England)

Electrotehnica (Bucharest)
Electrotehnica (Bucharest) (Romania)

Elektrie
Elektrie (East Germany)
Supersedes Deut. Elektrotech.

Elektrizitaetswirtschaft
Elektrizitaetswirtschaft (West Germany)

Elektro-Anz.
Elektro-Anzeiger (West Germany)

Elektronika
Elektronika (Formerly Przeglad Elektroniki) (Poland)

Elektron. Obrab. Mater.
Elektronnaya Obrabotka Materialov (Moldavian S.S.R.)

Elektron. Rechenanlagen
Elektronische Rechenanlagen (West Germany)

Elektroprivreda
Elektroprivreda (Yugoslavia)

Elektrotech. Cas.
Elektrotechnicky Casopis (Czechoslovakia)

Elektrotech. Maschinenbau
Elektrotechnik und Maschinenbau (Austria)

Elektrotechniek
Elektrotechniek (Netherlands)

Elektrotech. Obz.
Elektrotechniky Obzor (Czechoslovakia)

Elektrotech. Z., A
Elektrotechnische Zeitschrift, A (West Germany)

Elektrotech. Z., B
Elektrotechnische Zeitschrift, B (West Germany)

Elektroteh. Vestn.
Elektrontehniski Vestnik (Yugoslavia)

Elelmez. Ipar
Elelmezesi Ipar (Hungary)

Elelmiszervizsgalati Kozlem.
Elelmiszervizsgalati Kozlemenyek (Hungary)

Endeavour
Endeavour (England)

Endocrinology
Endocrinology (U.S.)

Energ. Atomtech.
Energia es Atomtechnika (Hungary)

Energie
Energie (West Germany)

Energiewirt. Tagesfragen
Energiewirtschaftliche Tagesfragen (West Germany)

Energ. Nucl. (Madrid)
Energia Nuclear (Madrid) (Spain)

Energ. Nucl. (Milan)
Energia Nucleare (Milan) (Italy)

Energ. Nucl. (Paris)
Energie Nucleaire (Paris) (France)

Energ. Tech.
Energie und Technik (West Germany)

Energy Convers.
Energy Conversion (Formerly Advanced Energy Conversion)
(England)

Energy Int.
Energy International (U.S.)

Engei Gakkai Zasshi
Engei Gakkai Zasshi (Journal of the Japanese Society for
Horticultural Science) (Japan)

Eng. Fracture Mech.
Engineering Fracture Mechanics (England)

Eng. Graphics
Engineering Graphics (U.S.)

Eng. J. (Montreal)
Engineering Journal, The (Montreal) (Canada)

Eng. Mining J.
Engineering and Mining Journal (U.S.)

Entomol. Exp. Appl.
Entomologia Experimentalis et Applicata (Netherlands)

Entropie
Entropie (France)

Environ. Aff.
Environmental Affairs (U.S.)

Environ. Entomol.
Environmental Entomology (U.S.)

Environ. Lett.
Environmental Letters (U.S.)

Environ. Physiol. Biochem.
Environmental Physiology and Biochemistry (Denmark)
Supersedes Environ. Physiol.

Environ. Sci. Technol.
Environmental Science and Technology (U. S.)

Environ. This Mon.
Environment This Month, The (England)

EOS, Trans., Amer. Geophys. Union
EOS, Transactions, American Geophysical Union (U.S.)
Supersedes Trans. Amer. Geophys. Union

Erdoel-Erdgas Z.
Erdoel-Erdgas Zeitschrift (West Germany-Austria)

Erdoel Kohle, Erdgas, Petrochem.
Erdoel und Kohle, Erdgas, Petrochemie (West Germany)

Ernaehr.-Umsch.
Ernaehrungs-Umschau (West Germany)

Erzmetall
Erzmetall (West Germany)
Supersedes Z. Erzbergbau Metallhuettenw.

Essays Phys.
Essays in Physics (England)

Euphytica
Euphytica. Netherlands Journal of Plant Breeding
(Netherlands)

Eur. J. Biochem.
European Journal of Biochemistry (Formerly Biochemische
Zeitschrift) (West Germany)

Eur. J. Cancer
European Journal of Cancer (England)

Eur. Neurol.
European Neurology (Switzerland)
Supersedes Section B of Psychiatria et Neurologia

Euro-Spectra
Euro-Spectra. Scientifical and Technical Review of the
European Communities (Formerly Euratom Review) (Belgium)

Exp. Cell Res.
Experimental Cell Research (U.S.)

Experientia
Experientia (Switzerland)

Exp. Gerontol.
Experimental Gerontology (England)

Exp. Mech.
Experimental Mechanics (U.S.)

Exp. Mol. Pathol.
Experimental and Molecular Pathology (U.S.)

Exp. Neurol.
Experimental Neurology (U.S.)

Exp. Parasitol.
Experimental Parasitology (U.S.)

Exp. Tech. Phys.
Experimentelle Technik der Physik (East Germany)

## F

Fachber. Oberflaechentech.
Fachberichte fuer Oberflaechentechnik (West Germany)

Faktory Vnesh. Sredy Ikh Znachenie Zdrov'ya Naseleniya
Faktory Vneshnei Sredy i Ikh Znachenie dlya Zdorov'ya
Naseleniya (Ukrainian S.S.R.)

FAPIG (Tokyo)
FAPIG (Tokyo) (Japan)

Farbe Lack
Farbe und Lack (West Germany)

Farmaco (Pavia) Ed. Prat.
Farmaco, Il (Pavia), Edizione Pratica (Italy)

Farmakol. Toksikol.
Farmakologiya i Toksikologiya (U.S.S.R.)
Issued In English Translation as Pharmacology and
Toxicology (USSR)

Farm. Obz.
Farmaceuticky Obzor (Czechoslovakia)

FEBS (Fed. Eur. Biochem. Soc.) Lett.
FEBS (Federation of European Biochemical Societies) Letters
(Netherlands)

Femip. Kut. Intez. Kozlem.
Femiperi Kutato Intezet Kozlemenyei, A (Hungary)

Ferroelectrics
Ferroelectrics (England)

Fette-Seifen-Anstrichm.
Fette-Seifen-Anstrichmittel (Combined with
Ernaehrungsindustrie) (West Germany)

Fields Quanta
Fields and Quanta (England)

Fish. Technol.
Fishery Technology (India)

Fiskeridir. Skr., Ser. Tekhnol. Unders.
Fiskeridirektoratets Skrifter, Serie Tekhnologiske
Undersoekelser (Norway)

Fiz. Elem. Chastits At. Yadra
Fizika Elementarnykh Chastits i Atomnogo Yadra (U.S.S.R.)
Issued in English translation as Sov. J. Particles Nucl.

Fizika (Zagreb)
Fizika (Zagreb) (Yugoslavia)

Fiziol. Biokhim. Kul't. Rast.
Fiziologiya i Biokhimiya Kul'turnykh Rastenii
(Ukrainian S. S. R.)

Fiziol. Norm. Patol. (Bucharest)
Fiziologia Normala si Patologica (Bucharest) (Romania)

Fiziol. Zh., Akad. Nauk Ukr. RSR
Fiziologichnii Zhurnal, Akademiya Nauk Ukrainskoi RSR
(Ukrainian S.S.R.)

Fiz.-Khim. Mekh. Mater.
Fiziko-Khimicheskaya Mekhanika Materialov
(Ukrainian S.S.R.)
Issued in English translation as Soviet Materials Science

Fiz. Khim. Obrab. Mater.
Fizika i Khimiya Obrabotki Materialov (U.S.S.R.)

Fiz. Metal. Metalloved.
Fizika Metallov i Metallovedeniya, Akademiya Nauk SSSR,
Ural'skii Filial (U.S.S.R.)
For English Translation see The Physics of Metals and
Metallography (USSR)

Fiz. Plazmy Probl. Upr. Termoyad. Sin.
Fizika Plazmy i Problemy Upravlyaemogo Termoyadernogo
Sinteza (Ukrainian S.S.R.)

Fiz. Szemle
Fizikai Szemle (Hungary)

Fiz. Tekh. Poluprov.
Fizika i Tekhnika Poluprovodnikov (U.S.S.R.)
Issued in English Translation as Soviet Physics-
Semiconductors

Fleischwirtschaft
Fleischwirtschaft, Die (West Germany)

Fluess. Obst
Fluessiges Obst (West Germany)

FOA (Forsvarets Forsk.) Rep.
FOA (Forsvarets Forskningsanstalt) Reports (Sweden)

Folia Biol. (Krakow)
Folia Biologica (Krakow) (Poland)

Folia Biol. (Prague)
Folia Biologica (Prague) (Czechoslovakia)

Folia Med. (Naples)
Folia Medica (Naples) (Italy)

Folia Microbiol. (Prague)
Folia Microbiologica (Prague) (Czechoslovakia)

Folia Morphol. (Prague)
Folia Morphologica (Prague) (Czechoslovakia)

Fonderie
Fonderie (France)

Food Cosmet. Toxicol.
Food and Cosmetics Toxicology (England)

Food Ind. S. Afr.
Food Industries of South Africa (South Africa)

Forensic Sci.
Forensic Science (Switzerland)

Forsch. Ingenieurw.
Forschung im Ingenieurwesen (West Germany)

Fortschr. Chem. Forsch.
Fortschritte der Chemischen Forschung (West Germany)

Fortschr. Geb. Roentgenstr. Nuklearmed.
Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin (West Germany)

Fortschr. Phys.
Fortschritte der Physik (East Germany)

Forum (Chicago)
Forum, The (Chicago) (U.S.)

Fossekallen
Fossekallen (Norway)

Found. Phys.
Foundations of Physics (U.S.)

Fra Sundhedsstyr.
Fra Sundhedsstyrelsen (Denmark)

Fuel
Fuel. A Journal of Fuel Science (England)

Fuji Jiho
Fuji Jiho (The Fuji Electric Journal) (Japan)

Fujikura Densen Giho
Fujikura Densen Giho (Fujikura Technical Review) (Japan)

Fukui Daigaku Kogakubu Kenkyu Hokoku
Fukui Daigaku Kogakubu Kenkyu Hokoku (Memoirs of the Faculty of Engineering, Fukui University) (Japan)

Fukushima Igaku Zasshi
Fukushima Igaku Zasshi (Fukushima Medical Journal) (Japan)

Funkschau
Funkschau (West Germany)

Funtai Kogaku
Funtai Kogaku (Powder Engineering) (Japan)

Futures
Futures (England)

Fyz. Cas.
Fyzikalny Casopis, Vydavatel'stvo Slovenskej Akademie Vied (Czechoslovakia)

## G

Gakujutsu Geppo
Gakujutsu Geppo (Japanese Scientific Monthly) (Japan)

Galvano
Galvano (France)

Galvanotechnik
Galvanotechnik (West Germany)

Gamma Field Symp.
Gamma Field Symposia, Ibaraki (Japan)

Gann
Gann (Japan)

Gan No Rinsho
Gan No Rinsho (Japanese Journal of Cancer Clinics) (Japan)

Gas- Wasserfach
Gas- und Wasserfach, Das (West Germany)

Gas- Wasserfach, Wasser - Abwasser
Gas- und Wasserfach, Wasser - Abwasser (West Germany)
Continues in part Gas- und Wasserfach, Das

Gazz. Chim. Ital.
Gazzetta Chimica Italiana (Italy)

G. Bot. Ital.
Giornale Botanico Italiano (Formerly Nuovo Giornale Botanico Italiano (Nuova Serie)) (Italy)

Gdansk. Tow. Nauk., Rozpr. Wydz.
Gdanskie Towarzystwo Naukowe, Rozprawy Wydzialu (Poland)

Gemeinsames Amtsbl., A
Gemeinsames Amtsblatt, Ausgabe A (West Germany)

Genet. Agr.
Genetica Agraria (Italy)

Genetics
Genetics (U.S.)

Genetics, Suppl.
Genetics, Supplement (U.S.)

Genetika
Genetika (U.S.S.R.)
Issued in English Translation as Soviet Genetics

Genet. Slechteni
Genetika a Slechteni (Czechoslovakia)

Gen. Relativity Gravitation
General Relativity and Gravitation (England)

Genshi Doryoku Kenkyukai Teirei Kenkyukai Nenkai Hokokusho
Genshi Doryoku Kenkyukai Teirei Kenkyukai Nenkai Hokokusho (Japan)

Genshiryoku Hakusho
Genshiryoku Hakusho (Japan)

Genshiryoku Iinkai Geppo
Genshiryoku Iinkai Geppo (Journal of Atomic Energy Commission) (Japan)

Genshiryoku Kogyo
Genshiryoku Kogyo (Nuclear Engineering) (Japan)

Genshiryokusen
Genshiryokusen (Nuclear Ships) (Japan)

Geochem. Int. (Engl. Transl.)
Geochemistry International (English Translation of Selected Articles from Geokhimiya Together with Selected Translated Geochemical Papers from Other Languages) (U.S.)

Geochim. Cosmochim. Acta
Geochimica et Cosmochimica Acta (England)

Geod. Kartogr. Obzor.
Geodeticky a Kartograficky Obzor (Czechoslovakia)

Geofiz. App.
Geofizicheskaya Apparatura (U.S.S.R.)

Geofiz. Geol. Naft.
Geofizyka i Geologia Naftowa (Poland)

Geokhimiya
Geokhimiya (U.S.S.R.)
Selected Articles Appear in English Translation in Geochemistry International

Geol. Appl. Idrogeologia
Geologia Applicata e Idrogeologia (Italy)

Geol. Foren. Stockholm Forh.
Geologiska Foreningens i Stockholm Forhandlingar (Sweden)

Geol. Pruzkum
Geologicky Pruzkum (Czechoslovakia)

Geol. Soc. Amer., Bull.
Geological Society of America, Bulletin (U.S.)

Geomagn. Aeron. (USSR) (Engl. Transl.)
Geomagnetism and Aeronomy (USSR) (English Translation of Geomagnetizm i Aeronomiya) (U.S.)

Geophysica
Geophysica (Finland)

Geophysics
Geophysics (U.S.)

Geophys. J. Roy. Astron. Soc.
Geophysical Journal of The Royal Astronomical Society (England)

Gerontologia
Gerontologia (Switzerland)

**Getriebe Mot. Antriebselem.**
Getriebe Motoren Antriebselemente (West Germany)

**Gidrokhim. Mater.**
Gidrokhimicheskie Materialy (U.S.S.R.)

**Giessereiforschung**
Giessereiforschung (West Germany)

**Gig. Sanit.**
Gigiena i Sanitariya (U.S.S.R.)
Issued in English Translation as Hygiene and Sanitation (USSR)

**Gig. Tr. Prof. Zabol.**
Gigiena Truda i Professional'nye Zabolevaniya (U.S.S.R.)

**G-I-T (Glas- Instrum.-Tech.) Fachz. Lab.**
G-I-T (Glas- und Instrumenten-Technik) Fachzeitschrift fuer das Laboratorium (West Germany)

**Glastech. Ber.**
Glastechnische Berichte (West Germany)

**Glueckauf**
Glueckauf (West Germany)

**God. Vissh. Khimikotekhnol. Inst.**
Godishnik na Visshiya Khimikotekhnologicheski Institut (Bulgaria)

**God. Vissh. Tekh. Ucheb. Zaved., Fiz.**
Godishnik na Visshite Tekhnicheski Uchebni Zavedeniya, Fizika (Bulgaria)

**Gradinar. Lozar. Nauka**
Gradinarska i Lozarska Nauka (Yugoslavia)

**Growth**
Growth (U.S.)

**Grundforbattring**
Grundforbattring (Sweden)

**Gummi, Asbest, Kunstst.**
Gummi, Asbest, Kunststoffe (West Germany)

## H

**Haematologia (Budapest)**
Haematologia (Budapest) (Hungary)

**Haikan To Sochi**
Haikan To Sochi (Piping and Process Machinery) (Japan)

**Hakko Kogaku Zasshi**
Hakko Kogaku Zasshi (Journal of Fermentation Technology) (Japan)

**Han'guk Sikmul Poho Hakhoe Chi**
Han'guk Sikmul Poho Hakhoe Chi (Korean Journal of Plant Protection) (South Korea)

**Han'guk Sikp'um Kwahakhoe Chi**
Han'guk Sikp'um Kwahakhoe Chi (Journal of the Korean Society of Food Science and Technology) (South Korea)

**Hatsuden Suiryoku**
Hatsuden Suiryoku (Hydro Electric Power) (Japan)

**Haus Tech., Essen, Vortragsveroeff.**
Haus der Technik, Essen, Vortragsveroeffentlichungen (West Germany)

**Health Phys.**
Health Physics (England)

**Heat Transfer - Jap. Res.**
Heat Transfer - Japanese Research (U.S.)

**Heat Transfer - Sov. Res.**
Heat Transfer - Soviet Research (U.S.)

**Helv. Chim. Acta**
Helvetica Chimica Acta (Switzerland)

**Helv. Phys. Acta**
Helvetica Physica Acta (Switzerland)

**Herion-Inform.**
Herion-Informationen (West Germany)

**High Energy Chem. (USSR) (Engl. Transl.)**
High Energy Chemistry (USSR) (English Translation of Khimiya Vysokikh Energiya) (U. S.)

**High Temp. (USSR) (Engl. Transl.)**
High Temperature (USSR) (English Translation of Teplofizika Vysokikh Temperatur) (U. S.)

**High Temp. - High Pressures**
High Temperatures - High Pressures. International Journal of Research (England)

**High Temp. Sci.**
High Temperature Science. An International Journal (U.S. - England)

**Hihakai Kensa**
Hihakai Kensa (Journal of NDI) (Japan)

**Hilgardia**
Hilgardia (U.S.)

**Hiroshima Igaku**
Hiroshima Igaku (Journal of the Hiroshima Medical Association) (Japan)

**Hiroshima J. Med. Sci.**
Hiroshima Journal of Medical Sciences (Japan)

**Hitachi Hyoron**
Hitachi Hyoron (The Hitachi Review) (Japan)

**Hoken Butsuri**
Hoken Butsuri (Journal of Japan Health Physics Society) (Japan)

**Hokkaido Daigaku Kogakubu Kenkyu Hokoku**
Hokkaido Daigaku Kogakubu Kenkyu Hokoku (Bulletin of the Faculty of Engineering, Hokkaido University) (Japan)

**Hokkaidoritsu Eisei Kenkyushoho**
Hokkaidoritsu Eisei Kenkyushoho (Report of the Hokkaido Inst. of Public Health) (Japan)

**Holzforschung**
Holzforschung (West Germany)

**Honvedorvos**
Honvedorvos (Hungary)

**Hort. Res.**
Horticultural Research (Scotland)

**Horumon To Rinsho**
Horumon To Rinsho (Clinical Endocrinology) (Japan)

**Houille Blanche**
Houille Blanche, La (France)

**Hrana Ishrana**
Hrana i Ishrana (Yugoslavia)

**Hutn. Listy**
Hutnicke Listy (Czechoslovakia)

**Hwahak Konghak**
Hwahak Konghak (Journal of the Korean Institute of Chemical Engineers) (South Korea)

**Hyogo-Ken Gan Senta Nenpo**
Hyogo-Ken Gan Senta Nenpo (Annual Report of the Hyogo Cancer Center, Inc.) (Japan)

## I

**IBM J. Res. Develop.**
IBM Journal of Research and Development (U.S.)

**Ideen Exakten Wissens**
Ideen des Exakten Wissens. Wissenschaft und Technik in der Sowjetunion (West Germany)

**Iden**
Iden (Heredity) (Japan)

**IEEE (Inst. Elec. Electron. Eng.), Spectrum**
IEEE (Institute of Electrical and Electronics Engineers), Spectrum (U.S.)

**IEEE (Inst. Elec. Electron. Eng.), Trans. Antennas Propagation**
IEEE (Institute of Electrical and Electronics Engineers), Transactions on Antennas and Propagation (U.S.)

**IEEE (Inst. Elec. Electron. Eng.), Trans. Eng. Manage.**
IEEE (Institute of Electrical and Electronics Engineers), Transactions on Engineering Management (U.S.)

IEEE (Inst. Elec. Electron. Eng.), Trans. Magnet.
IEEE (Institute of Electrical and Electronics Engineers), Transactions on Magnetics (U.S.)

IEEE (Inst. Elec. Electron. Eng.), Trans. Nucl. Sci.
IEEE (Institute of Electrical and Electronics Engineers), Transactions on Nuclear Science (Formerly IRE (Institute of Radio Engineers), Transactions on Nuclear Science) (U.S.)

Igaku Kenkyu
Igaku Kenkyu (Acta Medica) (Fukouka) (Japan)

Igaku No Ayumi
Igaku No Ayumi (Progress in Medicine) (Japan)

Igiena (Bucharest)
Igiena (Bucharest) (Romania)

Ig. Sanita Pubblica
Igiene e Sanita Pubblica (Italy)

Ikakikaigaku Zasshi
Ikakikaigaku Zasshi (The Journal of Japanese Medical Instruments) (Japan)

Immunochemistry
Immunochemistry (England)

Immunology
Immunology (England)

Ind. Agr.
Industrie Agrarie (Italy)

Ind.-Anz.
Industrie-Anzeiger (West Germany)

Ind. At. Spatiales
Industries Atomiques et Spatiales (France)
Supersedes Ind. At. and Sci. Ind. Spatiales, beginning Jan. 1972

Ind. Chim. Belge
Industrie Chimique Belge (Belgium)

Ind. Conserve
Industria Conserve (Italy)

Ind. Eng. Chem., Fundam.
Industrial and Engineering Chemistry, Fundamentals (U.S.)

Ind. Eng. Chem., Process Design Develop.
Industrial and Engineering Chemistry, Process Design and Development (U.S.)

Ind. Eng. Chem., Prod. Res. Develop.
Industrial and Engineering Chemistry, Product Research and Development (U.S.)

Ind. Heat.
Industrial Heating (U.S.)

Indian J. Agr. Res.
Indian Journal of Agricultural Research (India)

Indian J. Agr. Sci.
Indian Journal of Agricultural Science, The (India)

Indian J. Anim. Res.
Indian Journal of Animal Research (India)

Indian J. Anim. Sci.
Indian Journal of Animal Sciences (India)
Supersedes Indian J. Vet. Sci. Anim. Husb.

Indian J. Biochem. Biophys.
Indian Journal of Biochemistry and Biophysics (India)
Continues Indian J. Biochem.

Indian J. Chem.
Indian Journal of Chemistry (India)

Indian J. Environ. Health
Indian Journal of Environmental Health (India)
Supersedes Environ. Health

Indian J. Exp. Biol.
Indian Journal of Experimental Biology (India)

Indian J. Genet. Plant Breed.
Indian Journal of Genetics and Plant Breeding (India)

Indian J. Hered.
Indian Journal of Heredity (India)

Indian J. Hist. Sci.
Indian Journal of History of Science (India)

Indian J. Med. Res.
Indian Journal of Medical Research, The (India)

Indian J. Phys.
Indian Journal of Physics and Proceedings of The Indian Association for the Cultivation of Science (India)

Indian J. Power River Valley Develop.
Indian Journal of Power and River Valley Development (India)

Indian J. Pure Appl. Math.
Indian Journal of Pure and Applied Mathematics (India)

Indian J. Pure Appl. Phys.
Indian Journal of Pure and Applied Physics (India)

Indian J. Radiol.
Indian Journal of Radiology (India)

Indian J. Radio Space Phys.
Indian Journal of Radio and Space Physics (India)

Indian J. Technol.
Indian Journal of Technology (Formerly Journal of Scientific and Industrial Research (India), Section D) (India)

Indian J. Theor. Phys.
Indian Journal of Theoretical PHysics (India)

Indian Mining Eng. J.
Indian Mining and Engineering Journal (India)

Ind. Lab. (USSR) (Engl. Transl.)
Industrial Laboratory (USSR) (English Translation of Zavodskaya Laboratoriya) (U.S.)

Ind. Miner.
Industrie Minerale (France)
Supersedes Revue de l'Industrie Minerale and Mines et Chimie

Ind. Obst- Gemueseverwert.
Industrielle Obst- und Gemueseverwertung (West Germany)

Ind. Saf.
Industrial Safety (England)

Infec. Immunity
Infection and Immunity (U. S.)

Inform. Bild. Wiss.
Informationen Bildung Wissenschaft (West Germany)

Inform. Quim. Anal., Pura Apl. Ind.
Informacion de Quimica Analitica, Pura y Aplicada a la Industria (Spain)

Infrared Phys.
Infrared Physics. An International Research Journal (England)

Ing.-Arch.
Ingenieur-Archiv Gesellschaft fuer Angewandte Mathematik und Mechanik (Germany)

Ingenieursblad
Ingenieursblad (Belgium)

Ingenieur (Utrecht)
Ingenieur, De (Utrecht) (Netherlands)

Ing. Nucl.
Ingegneria Nucleare (Italy)

Ing. Sanit.
Ingegneria Sanitaria (Italy)

Inorg. Chem.
Inorganic Chemistry (U.S.)

Inorg. Mater. (USSR) (Engl. Transl.)
Inorganic Materials (USSR) (English Translation of Izvestiya Akademii Nauk SSSR, Neorganicheskie Materialy) (U.S.)

Inorg. Nucl. Chem. Lett.
Inorganic and Nuclear Chemistry Letters (England-U.S.)

Inst. Mining Met., Trans./Sect. B
Institution of Mining and Metallurgy, Transactions/Section B. Applied Earth Science (Continues in Part Transactions of the Institution of Mining and Metallurgy) (England)

Instrum. Exp. Tech. (USSR) (Engl. Transl.)
Instruments and Experimental Techniques (USSR) (English Translation of Pribory i Tekhnika Eksperimenta) (U.S.)

Instrum. Technol.
Instrumentation Technology (Formerly ISA (Instrument Society of America) Journal) (U.S.)

Int. Arch. Allergy Appl. Immunol.
International Archives of Allergy and Applied Immunology
(Switzerland)

Int. At. Energy Agency Bull.
International Atomic Energy Agency Bulletin (Austria)

Int. Chem. Eng.
International Chemical Engineering. A Quarterly Journal of
Translations from Russia, Eastern Europe, and Asia (U.S.)

Int. J. Appl. Radiat. Isotop.
International Journal of Applied Radiation and Isotopes
(England)

Int. J. Cancer
International Journal of Cancer (Denmark)

Int. J. Chem. Kinet.
International Journal of Chemical Kinetics (U. S.)

Int. J. Contr.
International Journal of Control (England)

Int. J. Electron.
International Journal of Electronics (Formerly Journal of
Electronics and Control) (England)

Int. J. Eng. Sci.
International Journal of Engineering Science (England)

Int. J. Environ. Stud.
International Journal of Environmental Studies, The
(England)

Int. J. Fracture Mech.
International Journal of Fracture Mechanics (Netherlands)

Int. J. Heat Mass Transfer
International Journal of Heat and Mass Transfer (England)

Int. J. Magn.
International Journal of Magnetism (England - U. S.)

Int. J. Nondestruct. Test.
International Journal of Nondestructive Testing (U.S.)

Int. J. Numer. Methods Eng.
International Journal for Numerical Methods in Engineering
(England)

Int. J. Parasitol.
International Journal for Parasitology (England)

Int. J. Powder Met.
International Journal of Powder Metallurgy (U.S.)

Int. J. Quant. Chem.
International Journal of Quantum Chemistry (U.S.)

Int. J. Quant. Chem., Symp.
International Journal of Quantum Chemistry, Symposium
(U.S.)

Int. J. Radiat. Biol.
International Journal of Radiation Biology and Related
Studies in Physics, Chemistry and Medicine (England)

Int. J. Radiat. Phys. Chem.
International Journal for Radiation Physics and Chemistry
(England)

Int. J. Theor. Phys.
International Journal of Theoretical Physics (England)

Int. J. Vitam. Nutr. Res.
International Journal for Vitamin and Nutrition
Research (Switzerland)
Supersedes Int. Z. Vitaminforsch.

Invest. Ophthalmol.
Investigative Ophthalmology (U.S.)

Inz. Budownictwo
Inzynieria i Budownictwo (Poland)

Inzenyrske Stavby
Inzenyrske Stavby (Czechoslovakia)

Inzh.-Fiz. Zh.
Inzhenerno-Fizicheskii Zhurnal (Formerly Inzhenerno-
Fizicheskii Zhurnal, Akademii Nauk Belorusskoi SSR)
(Belorussian S.S.R.)

Ion Exch. Membranes
Ion Exchange and Membranes (England)

Ionos. Issled.
Ionosfernye Issledovaniya (U.S.S.R.)

IRS Kurz-Inform., Reihe B
IRS Kurz-Information, Reihe B (West Germany)

Iryo
Iryo (Medical Treatment) (Japan)

Ishikawajima-Harima Giho
Ishikawajima-Harima Giho (Ishikawajima-Harima Engineering
Review) (Japan)

Isotopenpraxis
Isotopenpraxis (East Germany)

Isotope Radiat. Res.
Isotope and Radiation Research (Egypt)

Israel J. Chem.
Israel Journal of Chemistry (Supersedes Bulletin of the
Research Council of Israel, Section A Chemistry) (Israel)

Israel J. Earth-Sci.
Israel Journal of Earth-Sciences (Israel)

Israel J. Med. Sci.
Israel Journal of Medical Sciences (Israel)

Issled. Genet.
Issledovaniya po Genetike (U.S.S.R.)

Istanbul Univ. Fen Fak. Mecm., Seri C
Istanbul Universitesi Fen Fakultesi Mecmuasi, Seri C
Astronomi-Fizik (Turkey)

Iugoslav. Physiol. Pharmacol. Acta
Iugoslavica Physiologica et Pharmacologica Acta
(Yugoslavia)

IVA Tidskr. Tek.-Vetensk. Forsk.
IVA (Ingenjorsvetenskapsakademien) Tidskrift for Teknisk-
Vetenskaplig Forskning (Sweden)
Supersedes Tek. Vetensk. Forsk.

Iwate Daigaku Kyoikugakubu Kenkyu Nenpo
Iwate Daigaku Kyoikugakubu Kenkyu Nenpo (The Annual Report
of the College of Education, Univ. of Iwate) (Japan)

Izotoptechnika
Izotoptechnika (Hungary)
Supersedes Atomtech. Tajek.

Izv. Akad. Nauk Arm. SSR, Ser. Fiz.
Izvestiya Akademii Nauk Armyanskoi SSR, Seriya Fizika
(Formerly part of Izvestiya Akademii Nauk Armyanskoi SSR,
Seriya Fiziko-Matematicheskikh Nauk) (Armenian S.S.R.)

Izv. Akad. Nauk Arm. SSR, Ser. Tekh. Nauk
Izvestiya Akademii Nauk Armyanskoi SSR, Seriya
Tekhnicheskikh Nauk (Armenian S.S.R.)

Izv. Akad. Nauk Azerb. SSR, Ser. Fiz.-Tekh. Mat. Nauk
Izvestiya Akademii Nauk Azerbaidzhanskoi SSR, Seriya Fiziko-
Tekhnicheskikh i Matematicheskikh Nauk
(Azerbaidzhan S.S.R.)

Izv. Akad. Nauk Est. SSR, Fiz. Mat.
Izvestiya Akademii Nauk Estonskoi SSR, Fizika Matematika
(Estonian S.S.R.) (Formerly a Part of Izvestiya Akademii
Nauk Estonskoi SSR, Seriya Fiziko-Matematicheskikh i
Tekhnicheskikh Nauk) (Estonian S.S.R.)

Izv. Akad. Nauk Est. SSR, Khim. Geol.
Izvestiya Akademii Nauk Estonskoi SSR, Khimiya Geologiya
(Estonian S.S.R.) (Formerly a Part of Izvestiya Akademii
Nauk Estonskoi SSR, Seriya Fiziko-Matematicheskikh i
Tekhnicheskikh Nauk) (Estonian S.S.R.)

Izv. Akad. Nauk Est. SSR, Ser. Biol.
Izvestiya Akademii Nauk Estonskoi SSR, Seriya
Biologicheskaya (Estonian S.S.R.)
Superseded by Izv. Akad. Nauk Est. SSR, Biol.

Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.
Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya
Fiziko-Matematicheskaya (Formerly Izvestiya Akademii Nauk
Kazakhskoi SSR, Seriya Fiziko-Matematicheskikh Nauk)
(Kazakh S.S.R.)

Izv. Akad. Nauk SSSR, Energ. Transp.
Izvestiya Akademii Nauk SSSR, Energetika i Transport
(U.S.S.R.)

Izv. Akad. Nauk SSSR, Fiz. Atmos. Okeana
Izvestiya Akademii Nauk SSSR, Fizika Atmosfery i Okeana
(U.S.S.R.)

Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza
Izvestiya Akademii Nauk SSSR, Mekhanika Zhidkosti i Gaza
(U.S.S.R.)
Issued in English Translation as Soviet Fluid Mechanics

**Izv. Akad. Nauk SSSR, Metal.**
Izvestiya Akademiya Nauk SSSR, Metally (Formerly Izvestiya Akademiya Nauk SSSR, Metallurgiya, Gornoe Delo) (U.S.S.R.)
Issued in English Translation as Russian Metallurgy

**Izv. Akad. Nauk SSSR, Ser. Biol.**
Izvestiya Akademii Nauk SSSR, Seriya Biologicheskaya (U.S.S.R.)

**Izv. Akad. Nauk SSSR, Ser. Fiz.**
Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya (U.S.S.R.)
Issued in English Translation as Bull. Acad. Sci., USSR, Phys. Ser.

**Izv. Akad. Nauk SSSR, Ser. Geol.**
Izvestiya Akademii Nauk SSSR, Seriya Geologicheskaya (U.S.S.R.)

**Izv. Akad. Nauk SSSR, Ser. Khim.**
Izvestiya Akademii Nauk SSSR, Seriya Khimicheskaya (U.S.S.R.)
Issued in English Translation as Bull. Acad. Sci., USSR, Div. Chem. Sci.

**Izv. Akad. Nauk Turkm. SSR, Ser. Fiz.-Tekh., Khim. Geol. Nauk**
Izvestiya Akademii Nauk Turkmenskoi SSR, Seriya Fiziko-Tekhnicheskikh, Khimicheskikh i Geologicheskikh Nauk (Turkmen S.S.R.)

**Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk**
Izvestiya Akademii Nauk Uzbekskoi SSR, Seriya Fiziko-Matematicheskikh Nauk (Uzbek S.S.R.)

**Izv. Fiz. Inst. Aneb, Bulg. Akad. Nauk.**
Izvestiya na Fizicheskiya Institut s Aneb, Bulgarska Akademiya na Naukite (Bulgaria)

**Izv. Inst. Elektron., Bulg. Akad. Nauk.**
Izvestiya na Instituta po Elektronika, Bulgarska Akademiya na Naukite (Bulgaria)

**Izv. Krym. Astrofiz. Observ.**
Izvestiya Krymskoi Astrofizicheskoi Observatorii (U.S.S.R.)

**Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Khim. Nauk**
Izvestiya Sibirskogo Otdeleniya Akademii Nauk SSSR, Seriya Khimicheskikh Nauk (U.S.S.R.)
Issued in English Translation as Siberian Chemistry Journal

**Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Tekh. Nauk**
Izvestiya Sibirskogo Otdeleniya Akademii Nauk SSSR, Seriya Tekhnicheskikh Nauk (U.S.S.R.)

**Izv. Vyssh. Ucheb. Zaved., Chern. Met.**
Izvestiya Vysshikh Uchebnykh Zavedenii, Chernaya Metallurgiya (U.S.S.R.)

**Izv. Vyssh. Ucheb. Zaved., Energ.**
Izvestiya Vysshikh Uchebnykh Zavedenii, Energetika (U.S.S.R.)

**Izv. Vyssh. Ucheb. Zaved., Fiz.**
Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika (U.S.S.R.)
Issued in English translation as Soviet Physics Journal

**Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.**
Izvestiya Vysshikh Uchebnykh Zavedenii, Khimiya i Khimicheskaya Tekhnologiya (U.S.S.R.) (U.S.S.R.)

**Izv. Vyssh. Ucheb. Zaved., Radiofiz.**
Izvestiya Vysshikh Uchebnykh Zavedenii, Radiofizika (U.S.S.R.)
Issued in English Translation as Soviet Radiophysics

**Izv. Vyssh. Ucheb. Zaved., Tsvet. Met.**
Izvestiya Vysshikh Uchebnykh Zavedenii, Tsvetnaya Metallurgiya (U.S.S.R.)

## J

**Jad. Energ.**
Jaderna Energie (Czechoslovakia)

**J. Adhes.**
Journal of Adhesion (U.S.)

**J. Aerosol Sci.**
Journal of Aerosol Science (England)

**J. Agr. Food Chem.**
Journal of Agricultural and Food Chemistry (U.S.)

**J. Agr. Sci.**
Journal of Agricultural Science, The (England)

**J. Air Pollut. Contr. Ass.**
Journal of the Air Pollution Control Association (U.S.)

**J. Ala. Dent. Ass.**
Journal of the Alabama Dental Association, The (U.S.)

**J. Amer. Ceram. Soc.**
Journal of The American Ceramic Society (U.S.)

**J. Amer. Chem. Soc.**
Journal of The American Chemical Society (U.S.)

**J. Amer. Concr. Inst.**
Journal of the American Concrete Institute (U.S.)

**J. Amer. Med. Ass.**
Journal of The American Medical Association (U.S.)

**J. Amer. Vet. Med. Ass.**
Journal of The American Veterinary Medical Association, The (U.S.)

**J. Amer. Water Works Ass.**
Journal of The American Water Works Association (U.S.)

**J. Anat.**
Journal of Anatomy (England)

**J. Anim. Morphol. Physiol.**
Journal of Animal Morphology and Physiology (India)

**J. Anim. Sci.**
Journal of Animal Science (U.S.)

**Jap. Anal.**
Japan Analyst (Bunseki Kagaku) (Japan)

**Jap. J. Appl. Phys.**
Japanese Journal of Applied Physics (Japan)

**Jap. J. Genet.**
Japanese Journal of Genetics (Idengaku Zasshi) (Japan)

**J. Appl. Bacteriol.**
Journal of Applied Bacteriology (England)

**J. Appl. Chem. Biotechnol.**
Journal of Applied Chemistry and Biotechnology (England)
Supersedes J. Appl. Chem. (London)

**J. Appl. Chem. USSR (Engl. Transl.)**
Journal of Applied Chemistry of the USSR (English Translation of Zhurnal Prikladnoi Khimii) (U.S.)

**J. Appl. Crystallogr.**
Journal of Applied Crystallography (Denmark)

**J. Appl. Electrochem.**
Journal of Applied Electrochemistry (England)

**J. Appl. Phys.**
Journal of Applied Physics (U.S.)

**J. Appl. Physiol.**
Journal of Applied Physiology (U.S.)

**J. Appl. Polym. Sci.**
Journal of Applied Polymer Science (U.S.)

**J. Assam Sci. Soc.**
Journal of the Assam Science Society (India)

**J. Ass. Offic. Anal. Chem.**
Journal of the Association of Official Analytical Chemists (Formerly Journal of the Association of Official Agricultural Chemists) (U.S.)

**J. Atmos. Sci.**
Journal of The Atmospheric Sciences (Formerly the Journal of Meteorology) (U.S.)

**J. Atmos. Terrest. Phys.**
Journal of Atmospheric and Terrestrial Physics (Northern Ireland)

**J. Aust. Inst. Agr. Sci.**
Journal of the Australian Institute of Agricultural Science, The (Australia)

**J. Bacteriol.**
Journal of Bacteriology (U.S.)

**J. Basic Eng.**
Journal of Basic Engineering, Transactions of The ASME, Series D (U.S.)
Superseded by J. Fluids Eng. and J. Mater. Eng.

**J. Belge Radiol.**
Journal Belge de Radiologie (Belgium)

J. Biol. Chem.
Journal of Biological Chemistry, The (U.S.)

J. Biol. Med. Nucl.
Journal de Biologie et de Medecine Nucleaires. Supplement au Bulletin d'Information A.T.E.N. (Association Technique pour l'Energie Nucleaire) (France)

J. Bone Joint Surg.
Journal of Bone and Joint Surgery, The (England)

J. Brit. Nucl. Energy Soc.
Journal of the British Nuclear Energy Society, The (Formerly Journal of the British Nuclear Energy Conference) (England)

J. Catal.
Journal of Catalysis (U.S.)

J. Cell. Physiol.
Journal of Cellular Physiology (Formerly Journal of Cellular and Comparative Physiology) (U.S.)

J. Chem. Doc.
Journal of Chemical Documentation (U.S.)

J. Chem. Eng. Data
Journal of Chemical and Engineering Data (U.S.)

J. Chem. Phys.
Journal of Chemical Physics, The (U.S.)

J. Chem. Soc., Chem. Commun.
Journal of the Chemical Society (London), Chemical Communications (England)
Supersedes J. Chem. Soc., D

J. Chem. Soc., Dalton Trans.
Journal of the Chemical Society (London), Dalton Transactions (England)
Supersedes in part J. Chem. Soc., A

J. Chem. Soc., Faraday Trans., I
Journal of the Chemical Society (London), Faraday Transactions, I (England)
Supersedes in part J. Chem. Soc., A and Trans. Faraday Soc.

J. Chem. Soc., Faraday Trans., II
Journal of the Chemical Society (London), Faraday Transactions, II (England)
Supersedes in part J. Chem. Soc., A and Trans. Faraday Soc.

J. Chem. Soc., Perkin Trans., II
Journal of the Chemical Society (London), Perkin Transactions, II (England)
Supersedes J. Chem. Soc., B

J. Chem. Thermodyn.
Journal of Chemical Thermodynamics, The (England - U.S.)

J. Chim. Phys.
Journal de Chimie Physique et de Physico-Chimie Biologique (France)

J. Chin. Chem. Soc. (Taiwan)
Journal of the Chinese Chemical Society (Taiwan) (China)

J. Chromatogr.
Journal of Chromatography (Netherlands)

J. Chromatogr. Sci.
Journal of Chromatographic Science (U.S.)
Supersedes Journal of Gas Chromatography

J. Chron. Dis.
Journal of Chronic Diseases (U.S.)

J. Clin. Endocrinol. Metab.
Journal of Clinical Endocrinology and Metabolism, The (U.S.)

J. Clin. Pathol.
Journal of Clinical Pathology (England)

J. Colloid Interface Sci.
Journal of Colloid and Interface Science (Formerly Journal of Colloid Science) (U.S.)

J. Colloid Sci.
Journal of Colloid Science (U.S.)
Superseded by Journal of Colloid and Interface Science (U.S.)

J. Comp. Neurol.
Journal of Comparative Neurology, The (U.S.)

J. Comput. Phys.
Journal of Computational Physics (U.S.)

J. Conn. State Dent. Ass.
Journal of the Connecticut State Dental Association (U.S.)

J. Coord. Chem.
Journal of Coordination Chemistry (England)

J. Cryst. Growth
Journal of Crystal Growth (Netherlands)

J. Dairy Res.
Journal of Dairy Research, The (England)

J. Dairy Sci.
Journal of Dairy Science (U.S.)

J. Dent. Ass. S. Afr.
Journal of the Dental Association of South Africa (South Africa)

J. Dent. Res.
Journal of Dental Research, The (U.S.)

J. Earth Sci., Nagoya Univ.
Journal of Earth Sciences, Nagoya University, The (Japan)

J. Econ. Entomol.
Journal of Economic Entomology (U.S.)

J. Electroanal. Chem.
Journal of Electroanalytical Chemistry (Netherlands)
Superseded by J. Electroanal. Chem. Interfacial Electrochem.

J. Electrochem. Soc.
Journal of the Electrochemical Society (U.S.)

Jemna Mech. Opt.
Jemna Mechanika a Optika (Czechoslovakia)

Jena Rev.
Jena Review (East Germany)

J. Endocrinol.
Journal of Endocrinology, The (England)

J. Eng. Ind.
Journal of Engineering for Industry. Transactions of the ASME (American Society of Mechanical Engineers), Series B (U.S.)

J. Eng. Math.
Journal of Engineering Mathematics (Netherlands)

J. Eng. Power
Journal of Engineering for Power, Transactions of the ASME (American Society of Mechanical Engineers), Series A (U.S.)

J. Environ. Qual.
Journal of Environmental Quality (U.S.)

Jernkontorets Ann.
Jernkontorets Annaler (Sweden)

JETP Lett. (USSR) (Engl. Transl.)
JETP Letters (USSR) (English Translation of Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki) (U.S.)

J. Exp. Med.
Journal of Experimental Medicine (U.S.)

J. Exp. Zool.
Journal of Experimental Zoology (U.S.)

J. Fac. Sci., Univ. Tokyo, Sect. IV
Journal of the Faculty of Science, University of Tokyo, Section IV. Zoology (Japan)

J. Fluid Mech.
Journal of Fluid Mechanics (England)

J. Food Sci.
Journal of Food Science (U.S.)

J. Forensic Sci.
Journal of Forensic Sciences (U.S.)

J. Fr. Med. Chir. Thorac.
Journal Francais de Medecine et Chirurgie Thoracique (France)

J. Funct. Anal.
Journal of Functional Analysis (U. S.)

J. Genet. Hum.
Journal de Genetique Humaine (Switzerland)

J. Gen. Virol.
Journal of General Virology (England)

J. Geol. Soc. Aust.
Journal of the Geological Society of Australia (Australia)

J. Geophys. Res.
Journal of Geophysical Research (U.S.)

J. Gerontol.
Journal of Gerontology (U.S.)

J. Heat Transfer
Journal of Heat Transfer, Transactions of the ASME (American Society of Mechanical Engineers), Series C (U.S.)

J. Hered.
Journal of Heredity, The (U.S.)

J. Histochem. Cytochem.
Journal of Histochemistry and Cytochemistry, The (U.S.)

Jibi Inko-ka
Jibi Inko-ka (Otolaryngology) (Japan)

J. Immunol.
Journal of Immunology (U.S.)

J. Indian Acad. Forensic Sci.
Journal of the Indian Academy of Forensic Sciences (India)

J. Indian Chem. Soc.
Journal of the Indian Chemical Society (India)

J. Inorg. Nucl. Chem.
Journal of Inorganic and Nuclear Chemistry (England)

J. Insect Physiol.
Journal of Insect Physiology (U. S.)

J. Inst. Chem. (India)
Journal of the Institution of Chemists (India) (India)
Supersedes Journal and Proceedings of the Institution of Chemists (India)

J. Inst. Eng. (India)
Journal of the Institution of Engineers (India) (India)

J. Inst. Fuel
Journal of the Institute of Fuel (England)

J. Inst. Nucl. Eng.
Journal of the Institution of Nuclear Engineers (England)
Supersedes Nuclear Energy

J. Inst. Telecommun. Eng.
Journal of the Institution of Telecommunication Engineers (India)

J. Invest. Dermatol.
Journal of Investigative Dermatology, The (U.S.)

J. Iron Steel Inst. (London)
Journal of the Iron and Steel Institute (London) (England)

J. Jap. Inst. Metals
Journal of the Japan Institute of Metals (Nippon Kinzoku Gakkaishi) (Japan)

J. Jap. Soc. Appl. Phys., Suppl.
Journal of the Japan Society of Applied Physics, Supplement (Japan)

J. Korean Inst. Elec. Eng.
Journal of the Korean Institute of Electrical Engineers, The (Daehan JeonkiHakhoe-ji) (South Korea)

J. Korean Inst. Metals
Journal of the Korean Institute of Metals (South Korea)

J. Korean Meteorol. Soc.
Journal of the Korean Meteorological Society (South Korea)

J. Korean Nucl. Soc.
Journal of the Korean Nuclear Society (South Korea)

J. Korean Phys. Soc.
Journal of the Korean Physical Society (South Korea)

J. Lab. Clin. Med.
Journal of Laboratory and Clinical Medicine, The (U.S.)

J. Label. Compounds
Journal of Labelled Compounds (Belgium)

J. Less-Common Metals
Journal of the Less-Common Metals (Netherlands)

J. Low Temp. Phys.
Journal of Low Temperature Physics (U.S.)

J. Lumin.
Journal of Luminescence (Netherlands)

J. Macromol. Sci., Part A
Journal of Macromolecular Science, Part A. Chemistry (Supersedes Journal of Macromolecular Chemistry) (U.S.)

J. Magn. Resonance
Journal of Magnetic Resonance (England)

J. Mar. Biol. Ass. U.K.
Journal of the Marine Biological Association of The United Kingdom (England)

J. Mass Spectrom. Ion Phys.
Journal of Mass Spectrometry and Ion Physics (Netherlands)

J. Mater. Sci.
Journal of Materials Science (England)

J. Math. Anal. Appl.
Journal of Mathematical Analysis and Applications (U.S.)

J. Math. Mech.
Journal of Mathematics and Mechanics (U.S.)
Changed to Indiana Univ. Math. J.

J. Math. Phys. (N.Y.)
Journal of MatHematical Physics (New York) (U.S.)

J. Mec.
Journal de Mecanique (France)

J. Mech. Phys. Solids
Journal of the Mechanics and Physics of Solids (England)

J. Med. Chem.
Journal of Medicinal Chemistry (U.S.)

J. Med. Entomol.
Journal of Medical Entomology (U.S.)

J. Med. Lyon
Journal de Medicine de Lyon (France)

J. Med. Primatol.
Journal of Medical Primatology (Switzerland)

J. Metals
Journal of Metals (U.S.)

J. Microscop.
Journal de Microscopie (France)

J. Microscopy
Journal of Microscopy (England)
Supersedes J. Roy. Microscop. Soc.

J. Mol. Biol.
Journal of Molecular Biology (England)

J. Mol. Spectrosc.
Journal of Molecular Spectroscopy (U.S.)

J. Mol. Struct.
Journal of Molecular Structure (Netherlands)

J. Nat. Cancer Inst.
Journal of the National Cancer Institute (U.S.)

J. Natur. Sci. Math.
Journal of Natural Sciences and Mathematics (Pakistan)

J. Neurochem.
Journal of Neurochemistry (England)

J. Non-Cryst. Solids
Journal of Non-Crystalline Solids (Netherlands)

J. Nucl. Biol. Med.
Journal of Nuclear Biology and Medicine (Supersedes in Part Minerva Nucleare) (Italy)

J. Nucl. Energy
Journal of Nuclear Energy (Formerly Journal of Nuclear Energy, Parts A and B, Reactor Science and Technology) (England)

J. Nucl. Mater.
Journal of Nuclear Materials (Journal des Materiaux Nucleaires) (Netherlands)

J. Nucl. Med.
Journal of Nuclear Medicine (U.S.)

J. Nucl. Sci. Technol. (Tokyo)
Journal of Nuclear Science and Technology (Tokyo) (Japan)

J. Occup. Med.
Journal of Occupational Medicine (U.S.)

J. Optimization Theory Appl.
Journal of Optimization Theory and Applications (U.S.)

J. Opt. Soc. Amer.
Journal of the Optical Society of America (U.S.)

J. Oral Surg.
Journal of Oral Surgery (U.S.)

J. Organometal. Chem. (Amsterdam)
Journal of Organometallic Chemistry (Amsterdam)
(Netherlands)

J. Org. Chem.
Journal of Organic Chemistry, The (U.S.)

J. Pak. Med. Ass.
Journal of the Pakistan Medical Association (Pakistan)

J. Palynol.
Journal of Palynology (India)

J. Parasitol.
Journal of Parasitology, The (U.S.)

J. Petrol. Technol.
Journal of Petroleum Technology (U.S.)

J. Pharm. Sci.
Journal of Pharmaceutical Sciences (U.S.)

J. Photogr. Sci.
Journal of Photographic Science (England)

J. Phys. (Paris)
Journal de Physique (Paris) (Formerly le Journal de Physique
et le Radium) (France)

J. Phys. (Paris), Colloq.
Journal de Physique (Paris), Colloque (France)

J. Phys., A (London)
Journal of Physics, A (London). Proceedings of the Physical
Society (General) (Supersedes in Part Proceedings of the
Physical Society (London)) (England)

J. Phys., B (London)
Journal of Physics, B (London). Proceedings of the Physical
Society (Atomic and Molecular Physics) (Supersedes in Part
Proceedings of the Physical Society (London)) (England)

J. Phys., C (London)
Journal of Physics, C (London) Proceedings of the Physical
Society (Solid State Physics) (Supersedes in Part
Proceedings of the Physical Society (London)) (England)

J. Phys., D (London)
Journal of Physics, D (London) (Supersedes British Journal
of Applied Physics) (England)

J. Phys., E (London)
Journal of Physics, E (Supersedes Journal of Scientific
Instruments) (England)

J. Phys., F (London)
Journal of Physics, F (London). Metal Physics (England)

J. Phys. Chem.
Journal of Physical Chemistry, The (U.S.)

J. Phys. Chem. Ref. Data
Journal of Physical and Chemical Reference Data (U.S.)

J. Phys. Chem. Solids
Journal of Physics and Chemistry of Solids (Formerly Physics
and Chemistry of Solids, The) (England)

J. Phys. Soc. Jap.
Journal of the Physical Society of Japan (Japan)

J. Plasma Phys.
Journal of Plasma Physics (England)

JPL Quart. Tech. Rev.
JPL (Jet Propulsion Laboratory) Quarterly Technical
Review (U.S.)

J. Polymer Sci., Polym. Chem. Ed.
Journal of Polymer Science, Polymer Chemistry Edition
(formerly Journal of Polymer Science, Part A-1.
Polymer Chemistry) (U.S.)

J. Polym. Sci., Polym. Lett. Ed.
Journal of Polymer Science, Polymer Letters Edition
(formerly Journal of Polymer Science, Part B.
Polymer Letters) (U.S.)

J. Polym. Sci., Polym. Phys. Ed.
Journal of Polymer Science, Polymer Physics Edition
(formerly Journal of Polymer Science, Part A-2.
Polymer Physics) (U.S.)

J. Polym. Sci., Part C
Journal of Polymer Science, Part C Polymer Symposia
(U.S.)

J. Polym. Sci., Part D
Journal of Polymer Science, Part D Macromolecular Reviews
(U.S.)

J. Power Div., Amer. Soc. Civil Eng.
Journal of the Power Division, Proceedings of the American
Society of Civil Engineers (U.S.)

J. Proc. Roy. Soc. N. S. W.
Journal and Proceedings of the Royal Society of New South
Wales (Australia)

J. Prosth. Dent.
Journal of Prosthetic Dentistry, The (U.S.)

J. Protozool.
Journal of Protozoology, The (U.S.)

J. Pub. Health Dent.
Journal of Public Health Dentistry (U.S.)

J. Quant. Spectrosc. Radiative Transfer
Journal of Quantitative Spectroscopy and Radiative Transfer
(England)

J. Radiat. Res.
Journal of Radiation Research (Japan)

J. Radioanal. Chem.
Journal of Radioanalytical Chemistry (Switzerland-Hungary)

J. Radiol., Electrol., Med. Nucl.
Journal de Radiologie, d'Electrologie, et de Medicine
Nucleaire (France)

J. Res. Inst. Catal., Hokkaido Univ.
Journal of the Research Institute for Catalysis, Hokkaido
University (Japan)

J. Res. Nat. Bur. Stand., A
Journal of Research of the National Bureau of Standards, A
(U.S.)

J. Res. Nat. Bur. Stand., B
Journal of Research of the National Bureau of Standards, B
(U.S.)

J. Res. U. S. Geol. Surv.
Journal of Research of the U.S. Geological Survey (U.S.)

J. S. Afr. Chem. Inst.
Journal of the South African Chemical Institute
(South Africa)

J. Sci. Ind. Res.
Journal of Scientific and Industrial Research (India)

J. Sci. Technol. (London)
Journal of Science and Technology (London) (England)
Supersedes G.E.C.-A.E.I. Journal of Science and Technology

J. Sediment. Petrol.
Journal of Sedimentary Petrology (U.S.)

J. Sheffield Univ. Met. Soc.
Journal of the Sheffield University Metallurgical Society
(England)

J. Solid State Chem.
Journal of Solid State Chemistry (U. S.)

J. Spacecraft Rockets
Journal of Spacecraft and Rockets (U.S.)

J. Statist. Phys.
Journal of Statistical Physics (U.S. - England)

J. Stored Prod. Res.
Journal of Stored Products Research (England)

J. Surg. Oncol.
Journal of Surgical Oncology (U. S.)

J. Surg. Res.
Journal of Surgical Research, The (U.S.)

J. Test. Eval.
Journal of Testing and Evaluation (U.S.)
Supersedes J. Mater.

J. Theor. Biol.
Journal of Theoretical Biology (England)

J. Ultrastruct. Res.
Journal of Ultrastructure Research (U.S.)

J. Univ. Poona
Journal of the University of Poona (India)

Junkatsu
Junkatsu (Journal of the Japan Society of Lubrication Engineers) (Japan)

J. Urol.
Journal of Urology, The (U.S.)

J. Vac. Sci. Technol.
Journal of Vacuum Science and Technology, The (U.S.)

J. Virol.
Journal of Virology (U.S.)

J. Water Pollut. Contr. Fed.
Journal of the Water Pollution Control Federation (Formerly Sewage and Industrial Wastes) (U.S.)

J. Wildlife Manage.
Journal of Wildlife Management (U.S.)

# K

Kagaku (Tokyo)
Kagaku (Tokyo) (Science) (Japan)

Kagaku Gijutsucho Geppo
Kagaku Gijutsucho Geppo (Bulletin of the Science and Technology Agency) (Japan)

Kagaku Kogaku
Kagaku Kogaku (Chemical Engineering) (Japan)

Kagaku Kogyo
Kagaku Kogyo (Chemical Industry) (Japan)

Kagaku No Ryoiki
Kagaku No Ryoiki (Journal of Japanese Chemistry) (Japan)

Kagaku No Ryoiki, Zokan
Kagaku No Ryoiki, Zokan (Journal of Chemisty, Supplement) (Japan)

Kagaku To Seibutsu
Kagaku To Seibutsu (Chemistry and Biology) (Japan)

Kagoshima Daigaku Igaku Zasshi
Kagoshima Daigaku Igaku Zasshi (Medical Journal of Kagoshima University) (Japan)

Kajima Kensetsu Gijutsu Kenkyusho Nempo
Kajima Kensetsu Gijutsu Kenkyusho Nempo (Annual Report of The Kajima Construction Technical Research Institute) (Japan)

Kakuriken Kenkyu Hokoku
Kakuriken Kenkyu Hokoku (Research Report of the Laboratory of Nuclear Science, Tohoku University) (Japan)

Kami Pa Gikyoshi
Kami Pa Gikyoshi (Journal of the Japanese Technical Association of Pulp and Paper Industry) (Japan)

Kanagawa-ken Kogyo Shikenjo Kenkyu Hokoku
Kanagawa-ken Kogyo Shikenjo Kenkyu Hokoku (Bulletin of the Industrial Research Institute of Kanagawa Prefecture) (Japan)

Kanazawa Irigaku Sosho
Kanazawa Irigaku Sosho (Journal of Radiology and Physical Therapy, University of Kanazawa, The) (Japan)

Karyoku Hatsuden
Karyoku Hatsuden (The Thermal Power) (Japan)

Katastrophenmedizin
Katastrophenmedizin (West Germany)

Kaut. Gummi Kunstst.
Kautschuk und Gummi Kunststoffe (West Germany)

Kawasaki Giho
Kawasaki Giho (Kawasaki Technical Review) (Japan)

Keio Igaku
Keio Igaku (Journal of the Keio Medical Society) (Japan)

Kem. Ind.
Kemija u Industriji (Yugoslavia)

Kem. Kozlem.
Kemiai Kozlemenyek (Formerly Magyar Tudomanyos Akademia Kemiai Tudomanyos Osztalyanak Kozlemenyei) (Hungary)

Kernenergie
Kernenergie (East Germany)

Kerntechnik
Kerntechnik Vereinigt mit Atompraxis. The Journal for Nuclear Engineers and Scientists (West Germany)

KFK Nachr.
KFK (Kernforschungszentrum Karlsruhe) Nachrichten (West Germany)

Kgl. Dan. Vidensk. Selsk., Mat.-Fys. Medd.
Kongelige Danske Videnskabernes Selskab, Det, Matematisk-Fysisk Meddelelser (Denmark)

Khidrol. Meteorol.
Khidrologiya i Meteorologiya (Bulgaria)

Khig. Zdraveopazvane
Khigiena i Zdraveopazvane (Bulgaria)

Khim. Neft. Mashinostr.
Khimicheskoe i Neftyanoe Mashinostroenie (U.S.S.R.) Issued in English translation as Chemical and Petroleum Engineering (USSR)

Khirurgiya (Sofia)
Khirurgiya (Sofia) (Bulgaria)

Kiel. Milchwirt. Forschungsber.
Kieler Milchwirtschaftliche Forschungsberichte (West Germany)

Kinet. Katal.
Kinetika i Kataliz (U.S.S.R.)
Issued in English Translation as Kinetics and Catalysis (USSR)

Kinki Daigaku Genshiryoku Kenkyusho Nenpo
Kinki Daigaku Genshiryoku Kenkyusho Nenpo (Annual Reports of Kinki University Atomic Energy Research Institute) (Japan)

Kinzoku Hyomen Gijutsu
Kinzoku Hyomen Gijutsu (The Journal of the Metal Finishing Society of Japan) (Japan)

Kinzoku Zairyo Gijutsu Kenkyusho Kenkyu Hokoku
Kinzoku Zairyo Gijutsu Kenkyusho Kenkyu Hokoku (Report of the National Research Institute for Metals) (Japan)

Koatsu Gasu
Koatsu Gasu (Journal of the Inst. for Safety of High Pressure Gas Engineering) (Japan)

Kobalt
Kobalt (West Germany)

Kobe Shosen Daigaku Kiyo. Dai-2-rui. Kokai, Kikan, Rigaku-hen
Kobe Shosen Daigaku Kiyo. Dai-2-rui. Kokai, Kikan, Rigaku-hen (Review of Kobe University of Mercantile Marine. Part II. Navigation, Marine Engineering, and Scientific Section) (Japan)

Kobunshi Kagaku
Kobunshi Kagaku (Chemistry of High Polymers) (Japan)

Kogyo Yosui
Kogyo Yosui (Industrial Water) (Japan)

Kogyo Zairyo
Kogyo Zairyo (Engineering Materials) (Japan)

Kokobyo Gakkai Zasshi
Kokobyo Gakkai Zasshi (The Journal of the Japan Stomatological Society) (Japan)

Kokuritsu Eiyo Kenkyusho Kenkyu Hokoku
Kokuritsu Eiyo Kenkyusho Kenkyu Hokoku (Research Report of the National Institute of Nutrition) (Japan)

Kolloid-Z. Z. Polym.
Kolloid-Zeitschrift und Zeitschrift fuer Polymere, zur Zeit Vereinigt mit den Kolloid-Beiheften (Formerly Kolloid-Zeitschrift, -Zeitschrift fuer Polymere) (West Germany)

Konkurito Janaru
Konkurito Janaru (Concrete Journal) (Japan)

Konstr., Elem., Method.
Konstruktion, Elemente, Methoden (West Germany)

Konstr. Ing. Ber.
Konstruktiver Ingenieurbau Berichte (West Germany)

Konstr. Masch.-, App.- Geraetebau
Konstruktion im Maschinen-, Apparate- und Geraetebau (West Germany)

Koroze Ochr. Mater.
Koroze a Ochrana Materialu (Czechoslovakia)

Korrosion
Korrosion (West Germany)

Koshu Eiseiin Kenkyu Hokoku
Koshu Eiseiin Kenkyu Hokoku (Bulletin of the Institute of Public Health) (Japan)

Kosm. Biol. Med.
Kosmicheskaya Biologiya i Meditsina (U.S.S.R.)
Issued in English Translation as Space Biology and Medicine (USSR)

Kosm. Issled.
Kosmicheskie Issledovaniya (U.S.S.R.)
Issued in English Translation as Cosmic Research (USSR)

Kosmos (Stockholm)
Kosmos (Stockholm) (Sweden)

Kotsu Igaku
Kotsu Igaku (The Journal of Transportation Medicine) (Japan)

Kovove Mater.
Kovove Materialy (Czechoslovakia)

Kraftfutter
Kraftfutter (West Germany)

Kuki Seijo
Kuki Seijo (Air Cleaning) (Japan)

Kumamoto Igakkai Zasshi
Kumamoto Igakkai Zasshi (The Journal of the Kumamoto Medical Society) (Japan)

Kunststoffe
Kunststoffe. Organ der Deutschen Kunstoff-Fachverbaende (West Germany)

Kuznechno-Shtampovochnoe Proizvod.
Kuznechno-Shtampovochnoe Proizvodstvo (U.S.S.R.)

Kvantovaya Elektron. (Moscow)
Kvantovaya Elektronika (Moscow) (U.S.S.R.)
Issued in English translation as Sov. J. Quantum Electron.

Kyushu Daigaku Kogaku Shuho
Kyushu Daigaku Kogaku Shuho (Technology Reports of the Kyushu University) (Japan)

Kyushu Ketsueki Kenkyu Dokokaishi
Kyushu Ketsueki Kenkyu Dokokaishi (Journal of Kyushu Hematological Society) (Japan)

## L

Lab. Anim. Sci.
Laboratory Animal Science (U.S.)
Supersedes Lab. Anim. Care

Lab. Delo
Laboratornoe Delo (U.S.S.R.)

Lab. Invest.
Laboratory Investigation. A Journal of Experimental Methods and Pathology (U.S.)

Lab. Pract.
Laboratory Practice (England)

Laekartidningen
Laekartidningen (Sweden)
Supersedes Svenska Laekartidningen

Lakokrasoch. Mater. Ikh Primen.
Lakokrasochnye Materialy i Ikh Primenenie (U.S.S.R.)

Lancet
Lancet, The (England)

Lastechniek
Lastechniek (Netherlands)

Latv. Lauksaimn. Akad. Raksti
Latvijas Lauksaimniecibas Akademijas Raksti (Latvian S.S.R.)

Latv. PSR Zinat. Akad. Vestis
Latvijas PSR Zinatnu Akademijas Vestis (Latvian S.S.R.)

Latv. PSR Zinat. Akad. Vestis, Fiz. Teh. Zinat. Ser.
Latvijas PSR Zinatnu Akademijas Vestis, Fizikas un Tehnisko Zinatnu Serija (Latvian S.S.R.)

Lebensm.-Wiss. Technol.
Lebensmittel-Wissenschaft und Technologie (Switzerland)

Lect. Theor. Phys.
Lectures in Theoretical Physics (U. S.)

Lesovedenie
Lesovedenie (U.S.S.R.)

Letop. Khig. Epidemiol. Inst.
Letopisi na Khigienno Epidemiologichnite Instituti (Bulgaria)

Lett. Nuovo Cim.
Lettere al Nuovo Cimento (Italy)

Liet. Fiz. Rinkinys
Lietuvos Fizikos Rinkinys (Lithuanian S.S.R.)

Liet. TSR Aukst. Mokyklu Mokslo Darb., Chem. Chem. Technol.
Lietuvos TSR Aukstu ju Mokyklu Mokslo Darbai, Chemija ir Chemine Technologija (Lithuanian S.S.R.)

Liet. TSR Mokslu Akad. Darbai, Ser. B
Lietuvos TSR Mokslu Akademijos Darbai, Serija B (Lithuanian S.S.R.)

Liet. TSR Mokslu Akad. Darbai, Ser. C
Lietuvos TSR Mokslu Akademijos Darbai, Serija C. Biologijos Mokslai (Lithuanian S.S.R.)

Light Metal Age
Light Metal Age (U.S.)

Limnol. Oceanogr.
Limnology and Oceanography (U.S.)

Lipids
Lipids (U.S.)

Liteinoe Proizvod.
Liteinoe Proizvodstvo (U.S.S.R.)

Lloydia
Lloydia. A Quarterly Journal of Biological Science (U.S.)

Lubric. Eng.
Lubrication Engineering (U.S.)

Lucr. Stiint., Inst. Agron., Cluj, Ser. Agr.
Lucrari Stiintifice, Institutul Agronomic Dr. Petru Groza, Cluj, Seria Agricultura (Romania)

## M

Mach. Design
Machine Design (U.S.)

Magn. Gidrodin.
Magnitnaya Gidrodinamika, Akademiya Nauk Latviiskoi SSR (Latvian S.S.R.)
Issued in English translation as Magnetohydrodynamics (USSR).

Magy. Fiz. Foly.
Magyar Fizikai Folyoirat (Hungary)

Magy. Kem. Foly.
Magyar Kemiai Folyoirat (Hungary)

Magy. Kem. Lapja
Magyar Kemikusok Lapja (Hungary)

Magy. Radiol.
Magyar Radiologia (Hungary)

Maintenance
Maintenance (France)

M.A.N. (Maschinenfabrik Augsburg-Nuernberg) Forschen, Planen, Bauen
M.A.N. (Maschinenfabrik Augsburg-Nuernberg) Forschen, Planen, Bauen (West Germany)

Mar. Biol.
Marine Biology (Constitutes Proceedings of the International Interdisciplinary Conference on Marine Biolgy) (West Germany - U.S.)

Maschinenschaden
Maschinenschaden (West Germany)

Mashinostroene
Mashinostroene (Bulgaria)

Mashinovedenie
Mashinovedenie (U.S.S.R.)

Mater. Eval.
Materials Evaluation (Formerly Nondestructive Testing)
(U.S.)

Materialpruefung
Materialpruefung (West Germany)

Mater. Res. Bull.
Materials Research Bulletin (U.S.)

Mater. Sci. Eng.
Materials Science and Engineering (Netherlands)

Mater. Tech.
Materiaux et Techniques (France)

Math. Biosci.
Mathematical Biosciences (U.S.)

Mat. Vesn., Nova Ser.
Matematichki Vesnik, Nova Seriya (Yugoslavia)

Meas. Tech. (USSR) (Engl. Transl.)
Measurement Techniques (USSR) (English Translation of
Izmeritelnaya Tekhnika) (U.S.)

Meccanica
Meccanica (Italy)

Mech. Chem. Eng. Trans.
Mechanical and Chemical Engineering Transactions
(Australia)

Mech. Eng.
Mechanical Engineering (U.S.)

Medd. Norsk Farm. Selsk.
Meddelelser fra Norsk Farmaceutisk Selskap (Norway)

Medd. Nor. Skogforsoeksv.
Meddelelser fra det Norske Skogforsoeksvesen (Norway)

Med. Dosw. Mikrobiol.
Medycyna Doswiadczalna i Mikrobiologia (Poland)

Med. J. Aust.
Medical Journal of Australia, THe (Australia)

Med. J. Hiroshima Univ.
Medical Journal of Hiroshima University
(Hiroshima Daigaku Igaku Zasshi) (Japan)

Med. Lavoro
Medicina del Lavoro, La (Italy)

Med. Nucl. -Radiobiol. Lat., Suppl.
Medicina Nucleare - Radiobiologica Latina, Suppl. (Italy)
Ceased publication

Med. Radiol.
Meditsinskaya Radiologiya (U.S.S.R.)
Issued in English translation as Med. Radiol. (USSR)

Med., Sci. Law
Medicine, Science and the Law (England)

Med. Welt
Medizinische Welt, Die (West Germany)

Meerestechnik
Meerestechnik/Marine Technology (West Germany)

Meh. Automat.
Mehanizacija i Automatizacija (Yugoslavia)

Meld. Norg. Landbrukshoegsk.
Meldinger fra Norges Landbrukshoegskole (Norway)

Melliand Textilber.
Melliand Textilberichte (West Germany)
Superseded by Melliand Textilber. Int.

Melliand Textilber. Int.
Melliand Textilberichte International (West Germany)
Supersedes Melliand Textilber.

Mem. Chubu Inst. Technol.
Memoirs of Chubu Institute of Technology (Chubu Koygo
Daigaku Kyo) (Japan)

Mem. Fac. Eng., Kobe Univ.
Memoirs of the Faculty of Engineering, Kobe University
(Japan)

Mem. Fac. Eng., Kyoto Univ.
Memoirs of the Faculty of Engineering, Kyoto University
(Japan)

Mem. Inst. Sci. Ind. Res., Osaka Univ.
Memoirs of the Institute of Scientific and Industrial
Research, Osaka University (Japan)

Mem. Konan Univ., Sci. Ser.
Memoirs of the Konan University, Science Series (Japan)

Mem. Sci. Rev. Met.
Memoires Scientifiques de la Revue de Metallurgie, Les
(Formerly a Part of Revue de Metallurgie) (France)

Mem. Soc. Roy. Sci. Liege
Memoires de la Societe Royale des Sciences de Liege
(Belgium)

Mes., Regul., Automat.
Mesures, Regulation, Automatisme (France)

Messtechnik
Messtechnik. Zeitschrift fuer Instrumentenkunde (Supersedes
Zeitschrift fuer Instrumentenkunde) (West Germany)

Metal Constr. Brit. Weld. J.
Metal Construction and British Welding Journal (England)
Supersedes British Welding Journal

Metal Finish.
Metal Finishing (U.S.)

Metall
Metall. Internazionale Zeitschrift fuer Technik und
Wirtschaft (West Germany)

Metalloberflaeche
Metalloberflaeche (West Germany)

Metallofizika
Metallofizika (Ukrainian S.S.R.)

Metallography
Metallography. An International Journal (U.S.)

Metal Progr.
Metal Progress (U.S.)

Metals Aust.
Metals Australia (Australia)

Metal Sci. Heat Treat. (USSR) (Engl. Transl.)
Metal Science and Heat Treatment (USSR) (English
Translation of Metallovedenie i Termicheskaya Obrabotka
Metallov) (U.S.)

Metal Sci. J.
Metal Science Journal (England)

Metals Eng. Quart.
Metals Engineering Quarterly (U.S.)

Metalurgia (Sao Paulo)
Metalurgia (Sao Paulo) (Brazil)

Metaux (Corros.-Ind.)
Metaux (Corrosion-Industrie) (France)

Met. Constr. Mec.
Metallurgie et la Construction Mecanique (France)

Met. Eng. - IIT (Indian Inst. Technol.) Bombay
Metallurgical Engineer - IIT (Indian Institute of
Technology) Bombay (India)

Meteoritika
Meteoritika (U.S.S.R.)

Meteorologie
Meteorologie, La (France)

Meteorol. Zpr.
Meteorologicke Zpravy (Czechoslovakia)

Method. Phys. Anal.
Methodes PHysiques d'Analyse (France)
Merged with Chem. Anal. (Paris) to form Analusis

Met. Ital.
Metallurgia Italiana (Includes the Section Atti Notizie,
Associazione Italiana de Metallurgia) (Italy)

Met. Metalloved. Chist. Metal., Sb. Nauch. Rabot
Metallurgiya i Metallovedenie CHistykh Metallov, Moskovskii
Inzhenerno-Fizicheskii Institut, Sbornik Nauchnykh Rabot
(U.S.S.R.)

Met. Rev. (Publ. in Metals Mater.)
Metallurgical Reviews (Published in Metals and Materials)
(England)
Changed to Int. Met. Rev.

Metrol. Insp.
Metrology and Inspection (England)

Metrologia
Metrologia (West Germany)

Met. Trans.
Metallurgical Transactions (formerly Transactions of the Metallurgical Society of AIME and Transactions Quarterly of American Society for Metals) (U. S.)

Mich. Acad.
Michigan Academician (U.S.)

Microchem. J.
Microchemical Journal (U.S.)

Micron
Micron (England)

Microtecnic (Lausanne)
Microtecnic (Lausanne) (Switzerland)

Mie Med. J.
Mie Medical Journal (Japan)

Mikrobiologija
Mikrobiologija (Yugoslavia)

Mikrobiologiya
Mikrobiologiya (U.S.S.R.)
For English Translation see Microbiology (USSR)

Mikrochim. Acta
Mikrochimica Acta (Formerly Mikrochimica et Ichoanalytica Acta) (Austria)

Milchwissenschaft
Milchwissenschaft (West Germany)

Mil. Med.
Military Medicine (U.S.)

Mineral. Mag.
Mineralogical Magazine and Journal of the Mineralogical Society (England)

Minerva Fisiconucl.
Minerva Fisiconucleare. Giornale di Fisica Sanitaria e Protezione Contro le Radiazioni (Italy)

Mining Met. Quart. (Engl. Transl.)
Mining and Metallurgy Quarterly (English Translation of Rudarsko-Metalurski Zbornik) (Yugoslavia)

Mitsubishi Denki Giho
Mitsubishi Denki Giho (Mitsubishi Denki Technical Review) (Japan)

Mitsubishi Juko Giho
Mitsubishi Juko Giho (Mitsubishi Heavy Industries Technical Review) (Japan)

Mitsui Zosen Giho
Mitsui Zosen Giho (Mitsui Technical Review) (Japan)

Mitt. Geb. Lebensmittelunters. Hyg.
Mitteilungen aus dem Gebiete der Lebensmitteluntersuchung und Hygiene (Switzerland)

Mitt. Ver. Grosskesselbesitzer
Mitteilungen der Vereinigung der Grosskesselbesitzer (West Germany)
Superseded by Mitt. Ver. Grosskesselbetr.

Mitt. Ver. Grosskesselbetr.
Mitteilungen der Vereinigung der Grosskesselbetreiber (Formerly Mitteilungen der Vereinigung der Grosskesselbesitzer) (West Germany)

Miyazaki Daigaku Kogakubu Kenkyu Hokoku
Miyazaki Daigaku Kogakubu Kenkyu Hokoku (Bulletin of the Faculty of Engineering, Miyazaki University) (Japan)

Mod. Packag.
Modern Packaging (U.S.)

Mod. Power Eng.
Modern Power and Engineering (Canada)

Mod. Unfallverhuet.
Moderne Unfallverhuetung (West Germany)

Mokuzai Gakkaishi
Mokuzai Gakkaishi (Journal of the Japan Wood Research Society) (Japan)

Mokuzai Kogyo
Mokuzai Kogyo (Wood Industry) (Japan)

Mol. Cryst. Liquid Cryst.
Molecular Crystals and Liquid Crystals (formerly Molecular Crystals) (England)

Mol. Gen. Genet.
Molecular and General Genetics (MGG) (Continuation of Zeitschrift fuer Vererbungslehre) (West Germany)

Mol. Phys.
Molecular Physics (England)

Molybdaen-Dienst
Molybdaen-Dienst (West Germany)

Monatsber. Deut. Akad. Wiss. Berlin
Monatsberichte der Deutschen Akademie der Wissenschaften zu Berlin (East Germany)

Mon. Notic. Roy. Astron. Soc.
Monthly Notices of the Royal Astronomical Society (England)

Monokrist. Tekh.
Monokristally i Tekhnika (Ukrainian S.S.R.)

Moon
Moon, The. An International Journal of Lunar Studies (Netherlands)

Motor Ship
Motor Ship (England)

Motortech. Z.
Motortechnische Zeitschrift (West Germany)

Muenchen. Med. Wochenschr.
Muenchener Medizinische Wochenschrift (West Germany)

Musz. Tud.
Muszaki Tudomany (Formerly Magyar Tudomanyos Akademia Muszaki Tudomanyok Osztayanak Kozlemenyeia) (Hungary)

Mutat. Res.
Mutation Research (Netherlands)
Absorbed Newslett. Environ. Mutagen Soc.

Mycopathol. Mycol. Appl.
Mycopathologia et Mycologia Applicata (Netherlands)

## N

Nachr. Chem. Tech.
Nachrichten aus Chemie und Technik (Supplement to Angew. Chem.) (West Germany)

Nagaoka Kogyo Koto Senmon Gakko Kenkyu Kiyo
Nagaoka Kogyo Koto Senmon Gakko Kenkyu Kiyo (Research Reports of the Nagaoka Technical College) (Japan)

Nagoya Kogyo Daigaku Gakuho
Nagoya Kogyo Daigaku Gakuho (Bulletin of the Nagoya Institute of Technology) (Japan)

Nagoya Kogyo Gijutsu Shikensho Hokoku
Nagoya Kogyo Gijutsu Shikensho Hokoku (Reports of the Government Industrial Research Institute, Nagoya) (Japan)

Nagoya Med. J.
Nagoya Medical Journal (Japan)

Nahrung
Nahrung, Die (East Germany)

Naika Hokan
Naika Hokan (Japanese Archives of Internal Medicine) (Japan)

Nat. Bur. Stand. (U.S.), Spec. Publ.
National Bureau of Standards (U.S.), Special Publication (U.S.)

Nat. Cancer Inst. Monogr.
National Cancer Institute Monograph (U.S.)

Nat. Tech. Rep. (Matsushita Elec. Ind. Co., Osaka)
National Technical Report (Matsushita Electric Industrial Co., Osaka) (Japan)

Nature (London)
Nature (London) (England)

Nature (London) New Biol.
Nature (London) New Biology (England)

Nature (London) Phys. Sci.
Nature (London) Physical Science (England)

Naturwissenschaften
Naturwissenschaften, Die (West Germany)

Naturwiss. Rundsch.
Naturwissenschaftliche Rundschau (West Germany)

Nauch. Tr., Gos. Nauch.-Issled. Proekt. Inst.
Redkometal. Prom.
Nauchnye Trudy, Gosudarstvennyi Nauchno-Issledovatel'skii
i Proektnyi Institut Redkometallicheskoi Promyshlennosti
(U.S.S.R.)

Nauch. Tr. Mosk. Inzh.-Ekon. Inst.
Nauchnye Trudy Moskovskogo Inzhenerno-Ekonomicheskogo
Instituta (U.S.S.R.)

Nauch. Tr. Vissh. Med. Inst., Sofia
Nauchni Trudove na Visshiya Meditsinski Institut, Sofia
(Bulgaria)

Naunyn-Schmiedebergs Arch. Pharmakol.
Naunyn-Schmiedebergs Archiv fuer Pharmakologie (Formerly
Archiv fuer Pharmakologie und Experimentelle Pathologie,
Naunyn-Schmiedebergs) (West Germany)

Nav. Eng. J.
Naval Engineers Journal (U.S.)

Ned. Melk- Zuiveltijdschr.
Nederlands Melk- en Zuiveltijdschrift (Netherlands)

Neoplasma
Neoplasma (Czechoslovakia)

Neue Huette
Neue Huette (East Germany)

Neue Tech.
Neue Technik (Switzerland)
Supersedes Neue Tech., A and B

Neue Verpack.
Neue Verpackung (West Germany)

Neurochirurgia
Neurochirurgia. Supplement to Fortschritte der Neurologie
und Psychiatrie (West Germany)

Neurol. Neurochir. Pol.
Neurologia i Neurochirurgia Polska (Poland)

New Engl. J. Med.
New England Journal of Medicine, The (U.S.)

New Phys. (S. Korea)
New Physics (South Korea)

New Phytol.
New Phytologist, The (England)

New Sci.
New Scientist (England)
Merged with Science Journal to form New Scientist and
Science Journal; changed back to New Scientist with
Dec. 2, 1971 issue

Nichidai Igaku Zasshi
Nichidai Igaku Zasshi (Nihon University Medical Journal)
(Japan)

Nihon Daigaku Seisan Kogakubu Hokoku
Nihon Daigaku Seisan Kogakubu Kokoku (Journal of the College
of Industrial Technology, Nihon University) (Japan)

Nippon Butsuri Gakkaishi
Nippon Butsuri Gakkaishi (Proceedings of the Physical
Society of Japan) (Japan)

Nippon Chikusan Gakkai-Ho
Nippon Chikusan Gakkai-Ho (Japanese Journal of
Zootechnical Science) (Japan)

Nippon Gan Chiryo Gakkai-Shi
Nippon Gan Chiryo Gakkai-Shi (Journal of Japan Society
for Cancer Therapy, The) (Japan)

Nippon Genshiryoku Gakkaishi
Nippon Genshiryoku Gakkaishi (Journal of the Atomic Energy
Society of Japan) (Japan)

Nippon Hinyokika Gakkai Zasshi
Nippon Hinyokika Gakkai Zasshi (The Japanese Journal of
Urology) (Japan)

Nippon Hoshasen Gijutsu Gakkai Zasshi
Nippon Hoshasen Gijutsu Gakkai Zasshi (Japanese Journal
of Radiological Technology) (Japan)

Nippon Hoshasen Kobunshi Kenkyu Kyokai Nempo
Nippon Hoshasen Kobunshi Kenkyu Kyokai Nempo (Annual Report
of the Japanese Association for Radiation Research on
Polymers) (Japan)
Discontinued

Nippon Igaku Hoshasen Gakkai Zasshi
Nippon Igaku Hoshasen Gakkai Zasshi (Nippon Acta Radiologica)
(Japan)

Nippon Iji Shimpo
Nippon Iji Shimpo (Japanese Medical Journal) (Japan)

Nippon Ishikai Zasshi
Nippon Ishikai Zasshi (The Journal of the Japan Medical
Association) (Japan)

Nippon Jozo Kyokai Zasshi
Nippon Jozo Kyokai Zasshi (Japan)

Nippon Kagaku Kaishi
Nippon Kagaku Kaishi (Journal of the Chemical Society of
Japan, Chemistry and Industrial Chemistry) (Japan)
Supersedes Nippon Kagaku Zasshi and Kogyo Kagaku Zasshi

Nippon Ketsueki Gakkai Zasshi
Nippon Ketsueki Gakkai Zasshi (Acta Haematologica Japonica)
(Japan)

Nippon Kikai Gakkai Rombunshu
Nippon Kikai Gakkai Rombunshu (Transactions of the Japanese
Society of Mechanical Engineers) (Japan)

Nippon Kinzoku Gakkai Kaiho
Nippon Kinzoku Gakkai Kaiho (Bulletin of the Japan
Institute of Metals) (Japan)

Nippon Kyobu Rinsho
Nippon Kyobu Rinsho (The Japanese Journal of Chest Diseases)
(Japan)

Nippon Naibumpi Gakkai Zasshi
Nippon Naibumpi Gakkai Zasshi (Folia Endocrinologica
Japonica) (Japan)

Nippon Nogeikagaku Kaishi
Nippon Nogeikagaku Kaishi (Journal of the Agricultural
Chemical Society of Japan) (Japan)

Nippon Oyo Dobutsu Konchu Gakkai-Shi
Nippon Oyo Dobutsu Konchu Gakkai-Shi (Japanese Journal
of Applied Entomology and Zoology) (Japan)

Nippon Rin Gakkai-Shi
Nippon Rin Gakkai-Shi (Journal of the Japanese Forestry
Society) (Japan)

Nippon Sanshigaku Zasshi
Nippon Sanshigaku Zasshi (The Journal of Sericultural
Science of Japan) (Japan)

Nippon Secchaku Kyokai Shi
Nippon Secchaku Kyokai Shi (Journal of the Adhesion
Society of Japan) (Japan)

Nippon Seikei Geka Gakkai Zasshi
Nippon Seikei Geka Gakkai Zasshi (Journal of Japanese
Orthopaedic Association) (Japan)

Nippon Seiko Giho
Nippon Seiko Giho (Japan Steel Works Technical Review)
(Japan)

Nippon Shokuhin Kogyo Gakkaishi
Nippon Shokuhin Kogyo Gakkaishi (Journal of Food Science and
Technology) (Japan)

Nippon Shonika Gakkai Zasshi
Nippon Shonika Gakkai Zasshi (Acta Paediatrica Japonica)
(Japan)

Nippon Suisan Gakkaishi
Nippon Suisan Gakkaishi (Bulletin of the Japanese Society
of Scientific Fisheries) (Japan)

NML (Nat. Met. Lab.) Tech. J. (Jamshedpur, India)
NML (National Metallurgical Laboratory) Technical Journal
(Jamshedpur, India) (India)

Nogyo Oyobi Engei
Nogyo Oyobi Engei (Agriculture and Horticulture) (Japan)

Non-Destruct. Test. (Guildford, Engl.)
Non-Destructive Testing (Guildford, England) (England)

Nord. Hyg. Tidskr.
Nordisk Hygienisk Tidskrift (Sweden)

Norsk Skogind.
Norsk Skogindustri (Norway)

Notas Fis., Cent. Brasil. Pesqui. Fis.
Notas de Fisica, Centro Brasileiro de Pesquisas Fisicas
(Brazil)

Nouv. Presse Med.
Nouvelle Presse Medicale, La (France)
Supersedes Presse Medicale, La

Nouv. Rev. Fr. Hematol.
Nouvelle Revue Francaise d'Hematologie (France)

Nowotwory
Nowotwory (Poland)

NTZ-Nachrtech. Z.
NTZ-Nachrichtentechnische Zeitschrift (West Germany)

Nucl. Active
Nuclear Active (South Africa)

Nucl. Data, Sect. A
Nuclear Data, Section A (U.S.)

Nucl. Data, Sect. B
Nuclear Data, Section B (U.S.)

Nucl. Eng. Des.
Nuclear Engineering and Design (Formerly Nuclear Structural Engineering) (Netherlands)

Nucl. Eng. Int.
Nuclear Engineering International Incorporating Nuclear Power (Formerly Nuclear Engineering) (England)

Nucleus (Bonn)
Nucleus (Bonn) (West Germany)

Nucleus (Calcutta)
Nucleus (Calcutta) (India)

Nucleus (Diliman, Quezon City)
Nucleus, The (Diliman, Quezon City) (Philippines)

Nucleus (Karachi)
Nucleus (Karachi) (Pakistan)

Nucl. Fusion
Nuclear Fusion (Journal of Plasma Physics and Thermonuclear Fusion) (Austria)

Nucl. India
Nuclear India (India)

Nucl. Instrum. Methods
Nuclear Instruments and Methods (Formerly Nuclear Instruments) (Netherlands)

Nucl.-Med.
Nuclear-Medizin (West Germany)

Nucl.-Med., Suppl.
Nuclear-Medizin, Supplementum (West Germany)

Nucl. News
Nuclear News (U.S.)

Nucl. Phys., A
Nuclear Physics, A (Netherlands)

Nucl. Phys., B
Nuclear Physics, B (Netherlands)

Nucl. Safety
Nuclear Safety (A Bimonthly Technical Progress Review) (U.S.)

Nucl. Sci. Appl., Ser. A
Nuclear Science and Applications, Series A (Pakistan)

Nucl. Sci. Eng.
Nuclear Science and Engineering (U.S.)

Nucl. Technol.
Nuclear Technology (U. S.)
Supersedes Nuclear Applications and Technology

Nukleonika
Nukleonika (Poland)

Nunt. Radiol.
Nuntius Radiologicus (Italy)

Nuovo Cim., A
Nuovo Cimento, Il, A (Italy)

Nuovo Cim., B
Nuovo Cimento, Il, B (Italy)

N. Y. State J. Med.
New York State Journal of Medicine (U.S.)

## O

Oak Ridge Nat. Lab. Rev.
Oak Ridge National Laboratory Review (U.S.)

Obstet. Gynecol.
Obstetrics and Gynecology (U.S.)

Obz. Mat. Fiz.
Obzornik za Matematiko in Fiziko (Yugoslavia)

Occup. Health (London)
Occupational Health (London) (England)

Ocean Eng.
Ocean Engineering (U.S.)

Oecologia (Berlin)
Oecologia (Berlin) (Continues in Part Zeitschrift fuer Morphologie und Oekologie der Tiere) (West Germany)

Oesterr. Akad. Wiss. Math.-Naturwiss. Kl., Anz.
Oesterreichische Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Klasse, Anzeiger (Austria)

Oesterr. Akad. Wiss., Math.-Naturwiss. Kl., Sitzungsber., Abt. II
Oesterreichische Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Klasse, Sitzungsberichte, Abteilung II (Austria)

Oesterr. Bot. Z.
Oesterreichische Botanische Zeitschrift (Austria)

Oesterr. Schwesternztg.
Oesterreichische Schwesternzeitung (Austria)

Ohio State Med. J.
Ohio State Medical Journal (U.S.)

Oikos
Oikos, Acta Oecologica Scandinavica (Denmark)

Okayama Daigaku Nogakubu Gakujutsu Hokoku
Okayama Daigaku Nogakubu Gakujutsu Hokoku (Scientific Reports of the Faculty of Agriculture, Okayama University) (Japan)

Okla., Agr. Exp. Sta., Tech. Bull.
Oklahoma, Agricultural Experiment Station, Technical Bulletin (U.S.)

Oncology
Oncology (Formerly Oncologia) (Switzerland)

Onsen Kagaku
Onsen Kagaku (Journal of the Balneological Society of Japan) (Japan)

Opt. Commun.
Optics Communications (Netherlands)

Optik
Optik. Zeitschrift fuer das Gesamte Gebeit der Licht-und Elektronenoptik (West Germany)

Opt. Spectra
Optical Spectra (U.S.)

Opt. Spectrosc. (USSR) (Engl. Transl.)
Optics and Spectroscopy (USSR) (English Translation of Optika i Spektroskopiya) (U.S.)

Oral Surg., Oral Med., Oral Pathol.
Oral Surgery, Oral Medicine, Oral Pathology (U.S.)

Org. Magn. Resonance
Organic Magnetic Resonance (England)

Orv. Hetil.
Orvosi Hetilap (Hungary)

Osaka Kogyo Gijutsu Shikenjo Kiho
Osaka Kogyo Gijutsu Shikenjo Kiho (Bulletin of the Government Industrial Research Inst., Osaka) (Japan)

Oxidation Metals
Oxidation of Metals (U. S.)

Oyo Butsuri
Oyo Butsuri (Journal of Applied Physics) (Japan)

## P

Pahlavi Med. J.
Pahlavi Medical Journal (Iran)

Pak. J. Sci. Ind. Res.
Pakistan Journal of Scientific and Industrial Research
(Pakistan)

Papier (Darmstadt)
Papier (Darmstadt) (West Germany)

Pap. Ship Res. Inst. (Jap.)
Papers of Ship Research Institute (Japan)

Parasitology
Parasitology (England)

Particle Accel.
Particle Accelerators (Scotland)

Particles Nucl.
Particles and Nuclei (U.S.)

Pathol.-Biol.
Pathologie-Biologie (France)

Pathol. Eur.
Pathologia Europaea (Belgium)

Patol. Fiziol. Eksp. Ter.
Patologicheskaya Fiziologiya i Eksperimentalnaya Terapiya
(U.S.S.R.)

Patol. Pol.
Patologia Polska (Poland)

Pediat. Res.
Pediatric Research (Formerly Annales Paediatrici)
(Switzerland)

Pediatrics
Pediatrics (U.S.)

Peintures, Pigments, Vernis
Peintures, Pigments, Vernis (France)

Period. Polytech. Elec. Eng.
Periodica Polytechnica. Electrical Engineering (Hungary)

Period. Polytech., Mech. Eng.
Periodica Polytechnica, Mechanical Engineering (Hungary)
Supersedes Periodica Polytechnica, Engineering

Pharmazie
Pharmazie, Die (West Germany)

Philipp. Nucl. J.
Philippine Nuclear Journal (Philippines)

Philips Res. Rep. Suppl.
Philips Research Reports Supplements (Netherlands)

Philips Tech. Rev.
Philips Technical Review (Netherlands)

Phil. Mag.
Philosophical Magazine, The (England)

Photochem. Photobiol.
Photochemistry and Photobiology (England)

Phys. Bl.
Physikalische Blaetter (West Germany)

Phys. Bull. (London)
Physics Bulletin (London) (England)

Phys. Can.
Physics in Canada (Canada)

Phys. Chem. Liquids
Physics And Chemistry of Liquids (England)

Phys. Earth Planet. Interiors
Physics of the Earth and Planetary Interiors (Netherlands)

Phys. Educ.
Physics Education (England)

Phys. Fluids
Physics of Fluids, The (U.S.)

Physica
Physica (Netherlands)

Physiol. Bohemoslov.
Physiologia Bohemoslovaca (Czechoslovakia)

Phys. Kondens. Mater.
Physik der Kondensierten Materie (West Germany)

Phys. Lett., A
Physics Letters, (Section) A (Netherlands)

Phys. Lett., B
Physics Letters, (Section) B (Netherlands)

Phys. Med. Biol.
Physics in Medicine and Biology (England)

Phys. Norv.
Physica Norvegica (Norway)

Phys. Rep.
Physics Reports. A Review Section of Physics Letters
(Section C) (Netherlands)

Phys. Rev., A
Physical Review, The, A. General Physics (U. S.)

Phys. Rev., B
Physical Review, The, B. Solid State (U. S.)

Phys. Rev., C
Physical Review, The, C. Nuclear Physics (U. S.)

Phys. Rev., D
Physical Review, The, D. Particles and Fields (U. S.)

Phys. Rev. Lett.
Physical Review Letters (U.S.)

Phys. Scr.
Physica Scripta (Sweden)
Supersedes Arkiv for Fysik

Phys. Sintering
Physics of Sintering (Yugoslavia)

Phys. Status Solidi (a)
Physica Status Solidi (a). Applied Research
(East Germany)
Supersedes in part Physica Status Solidi

Phys. Status Solidi (b)
Physica Status Solidi (b). Basic Research (East Germany)
Suprsedes in part Physica Status Solidi

Phys. Technol.
Physics in Technology (England)
Supersedes Rev. Phys. Technol.

Phys. Today
Physics Today (U.S.)

Phys. Unserer Zeit
Physik in Unserer Zeit (West Germany)

Phytochemistry
Phytochemistry (England - U.S.)

Phytopathol. Z.
Phytopathologische Zeitschrift (West Germany)

Planet. Space Sci.
Planetary and Space Science (England)

Planseeber. Pulvermet.
Planseeberichte fuer Pulvermetallurgie Vereinigt mit Powder
Metallurgy Bulletin (Austria)

Plant Dis. Rep.
Plant Disease Reporter (U.S.)

Plant Physiol.
Plant Physiology (U.S.)

Plant Soil
Plant and Soil (Netherlands)

Plasma Phys.
Plasma Physics (Formerly Journal of Nuclear Energy, Part C.
Plasma Physics-Accelerators-Thermonuclear Research)
(England)

Plaste Kaut.
Plaste und Kautschuk mit Fachteil Anstrichstoffe
(East Germany)

Plast. Massy
Plasticheskie Massy (U.S.S.R.)
Issued in English Translation as Soviet Plastics

Plast. Reconstr. Surg.
Plastic and Reconstructive Surgery and the Transplantation
Bulletin (U.S.)

Plast. Resinas
Plasticos y Resinas (Mexico)

Plating
Plating (U.S.)

Pochvovedenie
Pochvovedenie (U.S.S.R.)
For English Translation see Soviet Soil Science

Pokroky Mat. Fyz. Astron.
Pokroky Matematiky, Fiziky a Astronomie (Czechoslovakia)

Pokroky Praskove Met. VUPM
Pokroky Praskove Metalurgie VUPM (Vyzkumny Ustav pro
Praskovou Metalurgii) (Czechoslovakia)

Pol. Arch. Med. Wewn.
Polskie Archiwum Medycyny Wewnetrznej (Poland)

Politecnica (Quito)
Politecnica (Quito) (Ecuador)

Pol. Med. J.
Polish Medical Journal (Translation of Articles, from
Various Medical Journals) (Poland)

Pol'nohospodarstvo
Pol'nohospodarstvo (Czechoslovakia)

Pol. Przegl. Radiol. Med. Nukl.
Polski Przeglad Radiologii i Medycyny Nuklearnej (Poland)
Issued in English Translation as Polish Review of
Radiology and Nuclear Medicine

Pol. Tyg. Lek.
Polski Tygodnik Lekarski (Poland)

Poluprov. Tekh. Mikroelektron.
Poluprovodnikovaya Tekhnika i Mikroelektronika
(Ukrainian S.S.R.)

Polym. J.
Polymer Journal (Japan)

Polytech. Tijdschr., Elektrotech./Electron.
Polytechnisch Tijdschrift, Elektrotechniek/Elektronica
(Netherlands)

Polytech. Tijdschr., Procestech.
Polytechnisch Tijdschrift, Procestechniek (Netherlands)

Pomiary, Automat., Kontr.
Pomiary, Automatika, Kontrola (Poland)

Ponpu Kogaku
Ponpu Kogaku (Pump Engineering) (Japan)

Porosh. Met., Akad. Nauk Ukr. SSR
Poroshkovaya Metallurgiya, Akademiya Nauk Ukrainskoi SSR
(Ukrainian S.S.R.)
For English Translation see Soviet Powder Metallurgy and
Metal Ceramics

Port. Phys.
Portugaliae Physica (Portugal)

Postepy Astron.
Postepy Astronomii (Poland)

Postepy Astronaut.
Postepy Astronautyki (Poland)

Postepy Fiz.
Postepy Fizyki (Poland)

Potato Res.
Potato Research (Netherlands)
Supersedes Eur. Potato J.

Poultry Sci.
Poultry Science (U.S.)

Powder Met.
Powder Metallurgy (England)

Powder Technol.
Powder Technology (Netherlands)

Power Eng.
Power Engineering (U.S.)

Prac. Lek.
Pracovni Lekarstvi (Czechoslovakia)

Prakt. Metallog.
Praktische Metallographie (West Germany)

Pr. Cent. Inst. Ochrony Pracy
Prace Centralnego Instytutu Ochrony Pracy (Poland)

Precis. Metal
Precison Metal (Formerly Precision Metal Molding) (U.S.)

Prensa Med. Argent.
Prensa Medica Argentina, La (Argentina)

Pressedienst (Bundesmin. Bild. Wiss.)
Pressedienst (Bundesministerium fuer Bildung und
Wissenschaft) (West Germany)

Pr. Inst. Gospod. Wodnej
Prace Instytutu Gospodarki Wodnej (Poland)

Pr. Inst. Masz. Przeply.
Prace Instytutu Maszyn Przeplywowych (Poland)

Pr. Inst. Wlokien., Lodz
Prace Instytutu Wlokiennictwa, Lodz (Poland)

Probl. Fiz. Elem. Chastits At. Yadra
Problemy Fisiki Elementarnykh Chastits i Atomonogo
Yadra (U.S.S.R.)
Changed to Fiz. Elem. Chastits At. Yadra

Probl. Gematol. Pereliv. Krovi
Problemy Gematologii i Perelivaniya Krovi (U.S.S.R.)
Issued in English Translation as Problems of Hematology and
Blood Transfusion (USSR)

Probl. Kosm. Biol.
Problemy Kosmicheskoi Biologii (U.S.S.R.)

Probl. Proch. Mashinostr.
Problemy Prochnosti v Mashinostroenii (U.S.S.R.)

Probl. Prochnosti
Problemy Prochnosti (U.S.S.R.)

Proc. Amer. Power Conf.
Proceedings of the American Power Conference (U.S.)

Proc. Astron. Soc. Aust.
Proceedings of the Astronomical Society of Australia
(Australia)

Proc. Brit. Ceram. Soc.
Proceedings of the British Ceramic Society (England)

Proc. Cambridge Phil. Soc.
Proceedings of the Cambridge Philosophical Society
(England)

Process Instrum.
Process Instrumentation (England)
Supersedes Instrum. Pract.

Proc. Fac. Sci. Tokai Univ.
Proceedings of the Faculty of Science of Tokai University
(Japan)

Proc. IEEE (Inst. Elec. Electron. Eng.)
Proceedings of the IEEE (Institute of Electrical and
Electronics Engineers) (Formerly Proceedings of the
Institute of Radio Engineers) (U.S.)

Proc. Indian Acad. Sci., Sect. A
Proceedings of the Indian Academy of Sciences, Section A
(India)

Proc. Indian Acad. Sci., Sect. B
Proceedings of the Indian Academy of Sciences, Section B
(India)

Proc. Indian Nat. Sci. Acad., Part A
Proceedings of the Indian National Science Academy, Part A.
Physical Sciences (Formerly Proceedings of the National
Institute of Sciences of India, Part A) (India)

Proc. Inst. Elec. Eng. (London)
Proceedings of the Institution of Electrical Engineers, The
(London) (England)

Proc. Inst. Mech. Eng. (London)
Proceedings of the Institution of Mechanical Engineers
(London) (England)

Proc., Inst. Teknol. Bandung
Proceedings, Institut Teknologi Bandung (Indonesia)

Proc. Iowa Acad. Sci.
Proceedings of the Iowa Academy of Science (U.S.)

Proc. Jap. Conf. Radioisotop.
Proceedings of the Japan Conference on Radioisotopes
(Japan)

Proc. Nat. Acad. Sci. U. S. A.
Proceedings of the National Academy of Sciences of the
United States of America (U.S.)

Proc. Res. Inst. Atmos., Nagoya Univ.
Proceedings of the Research Inst. of Atmospherics, Nagoya
University (Japan)

Proc. Roy. Aust. Chem. Inst.
Proceedings of The Royal Australian Chemical Institute
(Australia)

Proc. Roy. Inst. Gt. Brit.
Proceedings of the Royal Institution of Great Britain
(England)

Proc. Roy. Soc. Edinburgh, Sect. A
Proceedings of the Royal Society of Edinburgh, Section A.
Mathematical and Physical Sciences (Scotland)

Proc. Roy. Soc. Edinburgh, Sect. B
Proceedings of the Royal Society of Edinburgh, Section B
Biology (Scotland)

Proc. Roy. Soc. (London), Ser. A
Proceedings of the Royal Society (London), Series A
(England)

Proc. Roy. Soc. Med.
Proceedings of the Royal Society of Medicine (England)

Proc. Soc. Anal. Chem.
Proceedings of the Society for Analytical Chemistry
(England)

Proc. Soc. Exp. Biol. Med.
Proceedings of the Society for Experimental Biology and
Medicine (U.S.)

Proc. (Tr.) P. N. Lebedev Phys. Inst. (USSR) (Engl. Transl.)
Proceedings (Trudy) of the P. N. Lebedev Physics Institute
(USSR) (English Translation of Trudy Fizicheskogo Instituta
imeni P. N. Lebedeva, Akademiya Nauk SSSR) (U.S.)

Prod. Probl. Pharm.
Produits et Problemes Pharmaceutiques (France)

Progr. Exp. Tumor Res.
Progress in Experimental Tumor Research (Switzerland)

Progr. High Temp. Phys. Chem.
Progress in High Temperature Physics and Chemistry
(England)

Progr. Nucl. Energy, Ser. IX
Progress in Nuclear Energy, Series IX (England-U.S.)

Progr. Powder Met.
Progress in Powder Metallurgy (U. S.)

Progr. Sci.
Progres Scientifique (France)

Progr. Stiintei
Progresele Stiintei (Romania)

Progr. Theor. Phys. (Kyoto)
Progress of Theoretical Physics (Kyoto) (Japan)

Prot. Metals (USSR) (Engl. Transl.)
Protection of Metals (USSR) (English Translation of
Zashchita Metallov) (U.S.)

Prum. Potravin
Prumysl Potravin (Czechoslovakia)

Przegl. Budowlany
Przeglad Budowlany (Poland)

Przegl. Geofiz.
Przeglad Geofizyczny (Poland)

Przegl. Geol.
Przeglad Geologiczny (Poland)

Przem. Chem.
Przemysl Chemiczny (Poland)

Przem. Spozyw.
Przemysl Spozywczy (Poland)

PTB Mitt.
PTB Mitteilungen. Amts- und Mitteilungsblatt der
Physikalisch-Technischen Bundesanstalt (West Germany)

Publ. Astron. Soc. Jap.
Publications of the Astronomical Society of Japan (Japan)

Publ. Astron. Soc. Pac.
Publications of the Astronomical Society of the Pacific
(U.S.)

Publ. Earth Phys. Br. (Ottawa)
Publications of the Earth Physics Branch (Ottawa) (Canada)
Supersedes Publ. Dominion Observ., Ottawa

Publ. Res. Inst. Math. Sci.
Publications of the Research Institute for Mathematical
Sciences (Japan)
Supersedes Series A

Pub. Util. Fortn.
Public Utilities Fortnightly (U.S.)

Pumps
Pumps-Pompes-Pumpen (England)

Punjab Univ. J. Math.
Punjab University Journal of Mathematics, The (Pakistan)

Pure Appl. Chem.
Pure and Applied Chemistry (The Official Journal of the
International Union of Pure and Applied Chemistry)
(England)

## Q

Qual. Eng.
Quality Engineer, The (England)

Quart. J. Mech. Appl. Math.
Quarterly Journal of Mechanics and Applied Mathematics
(England)

Quart. J. Roy. Astron. Soc.
Quarterly Journal of the Royal Astronomical Society, The
(England)

Quart. Med. Rev.
Quarterly Medical Review (India)

Quim. Ind. (Madrid)
Quimica e Industria (Madrid) (Spain)

## R

Radex Rundsch.
Radex Rundschau (Austria)

Radiat. Bot.
Radiation Botany (England)

Radiat. Data Rep.
Radiation Data and Reports (U.S.)
Supersedes Radiological Health Data and Reports

Radiat. Eff.
Radiation Effects (England)

Radiat. Res.
Radiation Research (U.S.)

Radiat. Res. Rev.
Radiation Research Reviews (Netherlands)

Radiats. Tekh.
Radiatsionnaya Tekhnika (U.S.S.R.)

Radiaz. Alta Energ.
Radiazioni di Alta Energia (Italy)

Radioact. Sea
Radioactivity in the Sea (Austria)

Radiobiol.-Radiother.
Radiobiologia-Radiotherapie (East Germany)

Radiochem. Radioanal. Lett.
Radiochemical and Radioanalytical Letters
(Switzerland - Hungary)

Radiochim. Acta
Radiochimica Acta (West Germany)

Radio Eng. Electron. Phys. (USSR) (Engl. Transl.)
Radio Engineering and Electronic Physics (USSR) (English
Translation of Radiotekhnika i Elektronika) (U.S.)

Radiographer
Radiographer (Australia)

Radiography
Radiography (England)

Radioisotopes (Tokyo)
Radioisotopes (Tokyo) (Japan)

Radioisotopy
Radioisotopy (Czechoslovakia)

Radiol. Clin. Biol.
Radiologia Clinica et Biologica (Formerly Radiologia
Clinica) (Switzerland)

Radiol. Med.
Radiologia Medica, La (Italy)

Radiologe
Radiologe (West Germany)

Radiology
Radiology (U.S.)

Radiol. Prot. Bull.
Radiological Protection Bulletin (England)

Radiol. Technol.
Radiologic Technology (Formerly X-Ray Technician) (U.S.)

Radioprotection
Radioprotection. Bulletin de la Societe Francaise de
Radioprotection (France)

Radio Sci.
Radio Science (Formerly Journal of Research of the National
Bureau of Standards, D) (U.S.)

Rad. Zavoda Fiz.
Radovi Zavoda za Fiziku (Yugoslavia)

Rakuno Kagaku No Kenkyu
Rakuno Kagaku No Kenkyu (Japanese Journal of Dairy Science)
(Japan)

Raumfahrtforschung
Raumfahrtforschung (Formerly Raketentechnik und
Raumfahrtforschung) (West Germany)

Rayonnements Ionis. Tech. Mes. Prot.
Rayonnements Ionisants Techniques de Mesures et de
Protection (France)

Reactor Technol.
Reactor Technology. A Quarterly Technical Progress Review
(Formerly Reactor and Fuel-Processing Technology) (U.S.)
Ceased publication

Reakts. Sposobnost Org. Soedin., Tartu. Gos. Univ.
Reaktsionnaya Sposobnost Organicheskikh Soedinenii,
Tartuskii Gosudarstvennyi Universitet (Estonian S.S.R.)
Issued in English Translation as Organic Reactivity

Rec. Aust. Acad. Sci.
Records of the Australian Academy of Science (Australia)

Rec. Chem. Progr.
Record of Chemical Progress (U.S.)

Rech. Aerosp.
Recherche Aerospatiale (France)

Recherche (Paris)
Recherche, La (Paris) (France)
Supersedes Atomes (Paris) and Nucleus (Paris)

Refractories (USSR) (Engl. Transl.)
Refractories (USSR) (English Translation of Ogneupory)
(U.S.)

Reinf. Plast. (London)
Reinforced Plastics (London) (England)

Rend. Semin. Mat. Fis. Milano
Rendiconti del Seminario Matematico e Fisico di Milano
(Italy)

Rentgenol. Radiol.
Rentgenologiya i Radiologiya (Bulgaria)

Rep. Inst. Ind. Sci., Univ. Tokyo
Report of the Institute of Industrial Science,
University of Tokyo (Japan)

Rep. Ionosphere Space Res. Jap.
Report of Ionosphere and Space Research in Japan (Japan)

Rep. Progr. Phys.
Reports on Progress in Physics (England)

Rep. Progr. Polym. Phys. Jap.
Reports on Progress in Polymer Physics in Japan (Japan)

Res. Commun. Chem. Pathol. Pharmacol.
Research Communications in Chemical Pathology and
Pharmacology (U.S.)

Res./Develop.
Research/Development (U.S.)

RES, J. Reticuloendothel. Soc.
RES, Journal of the Reticuloendothelial Society (U.S.)

Rev. Biol. Med. Nucl.
Revista de Biologia y Medicina Nuclear (Uruguay)

Rev. Brasil. Fis.
Revista Brasileira de Fisica (Brazil)

Rev. Chim. (Bucharest)
Revista de Chimie (Bucharest) (Romania)

Rev. Chim. Miner.
Revue de Chimie Minerale (France)

Rev. Coroz.
Revista de Coroziune (Romania)

Rev. Czech. Med.
Review of Czechoslovak Medicine (Czechoslovakia)

Rev. Eur. Etud. Clin. Biol.
Revue Europeenne d'Etudes Cliniques et Biologiques
(Formerly Revue Francaise d'Etudes Cliniques et
Biologiques) (France)
Superseded by Biomedicine

Rev. Fr. Elec.
Revue Francaise de l'Electricite (France)

Rev. Fr. Energ.
Revue Francaise de l'Energie (France)

Rev. Gen. Caout. Plast.
Revue Generale des Caoutchoucs et Plastiques (France)

Rev. Gen. Elec.
Revue Generale de l'Electricite (France)

Rev. Gen. Therm.
Revue Generale de Thermique (France)

Rev. Geogr. Phys. Geol. Dyn.
Revue de Geographie Physique et de Geologie Dynamique
(France)

Rev. Geophys. Space Phys.
Reviews of Geophysics and Space Physics (U. S.)
Supersedes Reviews of Geophysics

Rev. Hort. Viticult.
Revista de Horticultura si Viticultura (Romania)

Rev. Inst. Fr. Petrole Ann. Combust. Liquides
Revue de l'Institut Francais du Petrole et Annales des
Combustions Liquides (France)

Rev. Int. Oceanogr. Med.
Revue Internationale d'Oceanographie Medicale (France)

Rev. Med. Aeronaut. Spatiale
Revue de Medecine Aeronautique et Spatiale (France)
Supersedes Rev. Med. Aeronaut. (Paris)

Rev. Mex. Fis.
Revista Mexicana de Fisica (Mexico)

Rev. Mex. Fis., Supl. Fis. Apl.
Revista Mexicana de Fisica, Suplemento de Fisica Aplicada
(Mexico)

Rev. Mod. Phys.
Reviews of Modern Physics (U.S.)

Rev. Phys. Appl.
Revue de Physique Appliquee (Supplement au Journal de
Physique) (France)

Rev. Phys. Technol.
Review of Physics in Technology (England)

Rev. Port. Quim. (Lisbon)
Revista Portuguesa de Quimica (Lisbon) (Portugal)

Rev. Prat.
Revue du Praticien, La (France)

Rev. Quest. Sci.
Revue des Questions Scientifiques (Belgium)

Rev. Roum. Biochim.
Revue Roumaine de Biochimie (Romania)

Rev. Roum. Biol., Ser. Bot.
Revue Roumaine de Biologie, Serie Botanique (Romania)

Rev. Roum. Biol., Ser. Zool.
Revue Roumaine de Biologie, Serie Zoologie (Supersedes in
Part Revue de Biologie, Academie de la Republique Populaire
Roumaine) (Romania)

Rev. Roum. Chim.
Revue Roumaine de Chimie (Continuation of Revue de Chimie,
Academie de la Republique Populaire Roumaine) (Romania)

Rev. Roum. Math. Pures Appl.
Revue Roumaine de Mathematiques Pures et Appliquees
(Romania)

Rev. Roum. Med. Interne
Revue Roumaine de Medecine Interne (Romania)

Rev. Roum. Phys.
Revue Roumaine de Physique (Romania)

Rev. Roum. Physiol.
Revue Roumaine de Physiologie (Romania)

Rev. Roum. Sci. Tech., Ser. Mecan. Appl.
Revue Roumaine des Sciences Techniques, Serie de Mecanique Appliquee (Romania)

Rev. Sci. Instrum.
Review of Scientific Instruments, The (U.S.)

Ric. Mat.
Ricerche di Matematica (Italy)

Rikagaku Kenkyusho Hokoku
Rikagaku Kenkyusho Hokoku (Reports of the Institute of Physical and Chemical Research) (Japan)

Rinsho Fujinka Sanka
Rinsho Fujinka Sanka (Clinical Gynecology and Obstetrics) (Japan)

Rinsho Hoshasen
Rinsho Hoshasen (Japanese Journal of Clinical Radiology) (Japan)

Rinsho Kagaku
Rinsho Kagaku (Japan)

Rinsho Seikei Geka
Rinsho Seikei Geka (Clinical Orthopedic Surgery) (Japan)

Riso
Riso (Italy)

Riv. Ital. Ig.
Rivista Italiana d Igiene (Italy)

Riv. Nuovo Cim.
Rivista del Nuovo Cimento (Italy)
Supersedes Supplemento al Nuovo Cimento

Rocz. Chem.
Roczniki Chemii (Poland)

Rocz. Panstw. Zakl. Hig.
Roczniki Panstwowego Zakladu Higieny (Poland)

Roentgenpraxis
Roentgenpraxis (West Germany)

Rozpr. Cesk. Akad. Ved, Rada Tech. Ved.
Rozpravy Ceskoslovenske Akademie Ved, Rada Technickych Ved (Czechoslovakia)

Rudarsko-Met. Zbornik
Rudarsko-Metalurski Zbornik (Yugoslavia)
For English Translation see Mining and Metallurgy Quarterly

Rudy (Prague)
Rudy (Prague) (Czechoslovakia)

Rudy Metale Niezelaz.
Rudy i Metale Niezelazne (Poland)

RUM, Rev. Universelle Mines
RUM, Revue Universelle des Mines, de la Metallurgie, de la Mecanique, des Travaux Publics, des Sciences et des Arts Appliques a l'Industrie (Formerly Revue Universelle des Mines, de la Metallurgie, de la Mecanique, des Travaux Publics, des Sciences et des Arts Appliques l'Industrie) (Belgium)

Russ. J. Phys. Chem. (Engl. Transl.)
Russian Journal of Physical Chemistry (English Translation of Zhurnal Fizicheskoi Khimii) (England)

## S

S. Afr. Mech. Eng.
South African Mechanical Engineer, The (South Africa)

S. Afr. Mining Eng. J.
South African Mining and Engineering Journal (South Africa)

Sahko
Sahko. Electricity in Finland (Finland)

Saitama Daigaku Kiyo, Shizenkagaku-Hen
Saitama Daigaku Kiyo, Shizenkagaku-Hen (Journal of Saitama Univ., Natural Science) (Japan)

Samoletostr. Tekh. Vozdush. Flota
Samoletostroenie i Tekhnika Vozdushnogo Flota (Ukrainian S.S.R.)

SAMPE Quart.
SAMPE Quarterly (U.S.)

Sanfujinka No Jissai
Sanfujinka No Jissai (Journal of Gynecological Practice) (Japan)

Sangyo Kikai
Sangyo Kikai (Industrial Machinery) (Japan)

Sb. Statei, Mosk. Inzh.-Fiz. Inst.
Sbornik Statei, Moskovskii Inzhenerno-Fizicheskii Institut (U.S.S.R.)

Sb. Tr. Chelyabinsk. Elektromet. Komb.
Sbornik Trudov Chelyabinsk Elektrometallurgiches-kogo Kombinata (U.S.S.R.)

Sb. Tr. Tsent. Nauch.-Issled. Inst. Chern. Met.
Sbornik Trudov Tsentral'nogo Nauchno-Issledovatel'skogo Instituta Chernoi Metallurgii (U.S.S.R.)

Sb. Ved. Odbornych Pr., Zavodni Ustav Narodniho Zadravi Uranoveho Prum., Pribram
Sbornik Vedeckych a Odbornych Praci, Zavodni Ustav Narodniho Zdravi Uranoveho Prumyslu, Pribram (Czechoslovakia)

Sb. Ved. Pr. VLVDU Hradci Kralove
Sbornik Vedeckych Praci VLVDU (Vojenskeho Lekarskeho Vyzkumneho a Doskolovaciho Ustavu) JEP v Hradci Kralove (Czechoslovakia)

Scand. J. Clin. Lab. Invest., Suppl.
Scandinavian Journal of Clinical and Laboratory Investigation, Supplement (Norway)

Scand. J. Dent. Res.
Scandinavian Journal of Dental Research (Denmark)

Scand. J. Gastroenterol.
Scandinavian Journal of Gastroenterology (Norway)

Scand. J. Haematol.
Scandinavian Journal of Haematology (Denmark)

Scand. J. Met.
Scandinavian Journal of Metallurgy (Sweden)

Scand. J. Plast. Reconstr. Surg.
Scandinavian Journal of Plastic and Reconstructive Surgery (Sweden)

Schiff Hafen
Schiff und Hafen (West Germany)

Schweissen Schneiden
Schweissen und Schneiden (West Germany)

Schweisstechnik (Berlin)
Schweisstechnik (Berlin) (East Germany)

Schweiz. Med. Wochensch.
Schweizerische Medizinische Wochenschrift (Switzerland)

Sci. Amer.
Scientific American (U.S.)

Sci. Avenir
Sciences et Avenir (France)

Sci. Cult. (Calcutta)
Science and Culture (Calcutta) (India)

Science
Science (U.S.)

Sci. Ind. (Karachi)
Science and Industry (Karachi) (Pakistan)

Sci. Pap. Inst. Phys. Chem. Res. (Jap.)
Scientific Papers of the Institute of Physical and Chemical Research (Japan) (Formerly Journal of the Scientific Research Institute (Japan)) (Japan)

Sci. Progr. (Oxford)
Science Progress (Oxford) (England)

Sci. Progr. Decouverte
Science Progres Decouverte (Formerly Science Progres - La Nature) (France)

Sci. Pub., Res. Inst. Radiol. Radiat. Hyg.
Scientific Publications, Research Institute of Radiology and Radiation Hygiene (Bulgaria)

Sci. Rep. Res. Inst., Tohoku Univ., Ser. A
Science Reports of the Research Institutes, The, Tohoku University, Series A (Japan)

Sci. Rev. (Manila)
Science Review (Manila) (Philippines)

Sci. Total Environ.
Science of the Total Environment (Netherlands)

Scot. Med. J.
Scottish Medical Journal (Scotland)

Scr. Met.
Scripta Metallurgica (U.S.)

Search
Search. Science, Technology and Society (Australia)
Supersedes Australian Journal of Science

Secur. Med. Trav.
Securite et Medecine du Travail (France)

Seifen-Oele-Fette-Wachse
Seifen-Oele-Fette-Wachse (West Germany)

Seimitsu Kikai
Seimitsu Kikai (Journal of the Japan Society of Precision Engineering) (Japan)

Seisan To Gijutsu
Seisan To Gijutsu (The Production and Technique) (Japan)

Sekiyu Gfjutsu Kyokaishi
Sekiyu Gijutsu Kyokaishi (Journal of the Japanese Association of Petroleum Technologists) (Japan)

Semin. Nucl. Med.
Seminars in Nuclear Medicine (U.S.)

Sempaku
Sempaku (Ship) (Japan)

Senpaku Gijutsu Kenkyujo Hokoku
Senpaku Gijutsu Kenkyujo Hokoku (Report of Ship Research Institute) (Japan)

Separ. Purif. Methods
Separation and Purification Methods (U.S.)
Supplement to Separation Science

Separ. Sci.
Separation Science (U.S.)

Seramikkusu
Seramikkusu (Ceramics) (Japan)

Ser. Haematol.
Series Haematologica (Supplements Scandinavian Journal of Haematology) (Denmark)

Shigaku
Shigaku (Odontology (Tokyo)) (Japan)

Shimadzu Hyoron
Shimadzu Hyoron (Shimadzu Review) (Japan)

Shimizu Kensetsu Kenkyusho-Ho
Shimizu Kensetsu Kenkyusho-Ho (Reports of the Research Lab. of Shimizu Construction Co., Ltd.) (Japan)

Shindan To Chiryo
Shindan To Chiryo (Diagnosis and Treatment) (Japan)

Shinkei Kenkyu No Shimpo
Shinkei Kenkyu No Shimpo (Advances in Neurological Sciences) (Japan)

Shinshu Daigaku Kogakubu Kiyo
Shinshu Daigaku Kogakubu Kiyo (Journal of the Faculty of Engfneering, Shinshu University) (Japan)

Shitsuryo Bunseki
Shitsuryo Bunseki (Mass Spectroscopy) (Japan)

Shock Vib. Bull.
Shock and Vibration Bulletin, The (U. S.)

Shokubai
Shokubai (Catalyst) (Japan)

Shokuhin Shosha
Shokuhfn Shosha (Food Irradiation, Japan) (Japan)

Shokuryo Kenkyujo Kenkyu Hokoku
Shokuryo Kenkyujo Kenkyu Hokoku, (Report of the Food Research Institute) (Japan)

Showa Igakkai Zasshi
Showa Igakkai Zasshi (The Journal of the Showa Medical Association) (Japan)

Siemens Forsch.-Entwicklungsber.
Siemens Forschungs-und Entwicklungsbericte (West Germany)

Siemens Rev.
Siemens Review (West Germany)

Siemens-Z.
Siemens-Zeitschrift (West Germany)

Silikaty
Silikaty (Czechoslovakia)

Simulation
Simulation (U.S.)

Sivilt Beredskap
Sivilt Beredskap (Norway)

Skoda Rev.
Skoda Review (Czechoslovakia)

Sky Telesc.
Sky and Telescope (U.S.)

Slaboproudy Obz.
Slaboproudy Obzor (Czechoslovakia)

S. Med. J.
Southern Medical Journal (U.S.)

Soil Sci.
Soil Science (U.S.)

Soil Sci. Soc. Amer., Proc.
Soil Science Society of America, Proceedings (U.S.)

Solar Energy
Solar Energy. Journal of Solar Energy Science and Engineering (U.S.)

Solar Phys.
Solar Physics (Netherlands)

Solid State Commun.
Solid State Communications (England-U.S.)

Solid-State Electron.
Solid-State Electronics. An International Journal (England)

Soobshch. Akad. Nauk Gruz. SSR
Soobshcheniya Akademii Nauk Gruzinskoi SSR (Georgian S.S.R.)

Soobshch. Inst. Agrokhim. Probl. Gidroponiki, Akad. Nauk Arm. SSR
Soobshcheniya Instituta Agrokhimicheskikh Problem i Gidroponiki, Akademiya Nauk Armyanskoi SSR (Armenian S.S.R.)

Soobshch. Shemakhinskoi Astrofiz. Observ., Akad. Nauk Azerb. SSR
Soobshcheniya Shemakhinskoi Astrofizicheskoi Observatorii, Akademiya Nauk Azerbaidzhanskoi SSR (Azerbaidzhan S.S.R.)

Soudage Tech. Connexes
Soudage et Techniques Connexes (France)

Southwest. Vet.
Southwestern Veterinarian, The (U.S.)

Sov. Astron. AJ (Engl. Transl.)
Soviet Astronomy-AJ (English Translation of Astronomicheskii Zhurnal) (U.S.)

Sov. J. Develop. Biol. (Engl. Transl.)
Soviet Journal of Developmental Biology (English Translation of Ontogenez) (U.S.)

Sov. J. Nondestruct. Test. (Engl. Transl.)
Soviet Journal of Nondestructive Testing (English Translation of Defektoskopiya) (U. S.)

Sov. Phys.-Cryst. (Engl. Transl.)
Soviet Physics-Crystallography (English Translation of Kristallografiya) (U.S.)

Sov. Phys.-Semicond. (Engl. Transl.)
Soviet Physics-Semiconductors (English Translation of Fizika i Tekhnika Poluprovodnikov) (U.S.)

Sov. Phys.-Solid State (Engl. Transl.)
Soviet Physics-Solid State (English Translation of Fizika Tverdogo Tela) (U.S.)

Sov. Phys.-Tech. Phys. (Engl. Transl.)
Soviet Physics-Technical Physics (English Translation of Zhurnal Tekhnicheskoi Fiziki) (U.S.)

Sov. Powder Met. Metal Ceram. (Engl. Transl.)
Soviet Powder Metallurgy and Metal Ceramics (English Translation of Poroshkovaya Metallurgiya, Akademiya Nauk Ukrainskoi SSR) (U.S.)

Sov. Radiochem. (Engl. Transl.)
Soviet Radiochemistry (English Translation of Radiokhimiya) (U.S.)

Sov. Soil Sci. (Engl. Transl.)
Soviet Soil Science (English Translation of Pochvovedenie) (U.S.)

Space Life Sci.
Space Life Sciences (Netherlands)

Space Sci. Rev.
Space Science Reviews (Netherlands)

SPARMO Bull.
SPARMO Bulletin. Solid Particles and Radiation Monitoring Organization (France)

Spectrochim. Acta, Part A
Spectrochimica Acta, Part A. Molecular Spectroscopy (England)

Spectrochim. Acta, Part B
Spectrochimica Acta, Part B. Atomic Spectroscopy (England)

Spectrosc. Lett.
Spectroscopy Letters (U.S.)

Spisy Prir. Fak., Univ. Brne
Spisy Prirodovedecke Fakulty, Universita v Brne (Czechoslovakia)

Sprechsaal Keram. Glas Email Silikate
Sprechsaal fuer Keramik Glas Email Silikate (West Germany)

Springer Tracts Mod. Phys.
Springer Tracts in Modern Physics. Ergebnisse der Exakten Naturwissenschaften (West Germany)

Staedtehygiene
Staedtehygiene (West Germany)

Staerke
Staerke, Die (West Germany)

Stahl Eisen
Stahl und Eisen (West Germany)

Stal
Stal (U.S.S.R.)

Staub-Reinhalt. Luft
Staub-Reinhaltung der Luft (West Germany)

Steklo Keram.
Steklo i Keramika (U.S.S.R.)
Issued in English Translation as Glass and Ceramics (USSR)

Stockholm Contrib. Geol.
Stockholm Contributions in Geology (Sweden)

Stomatologiya
Stomatologiya (U.S.S.R.)

Strahlentherapie
Strahlentherapie (West Germany)

Strain
Strain (England)

Strojirenstvi
Strojirenstvi (Czechoslovakia)

Strojnicky Cas.
Strojnicky Casopis (Czechoslovakia)

Strojniski Vestn.
Strojniski Vestnik (Yugoslavia)

Stud. Biophys.
Studia Biophysica (East Germany)

Stud. Cercet. Astron.
Studii si Cercetari de Astronomie (Romania)

Stud. Cercet. Biol., Ser. Bot.
Studii si Cercetari de Biologie, Seria Botanica (Romania)

Stud. Cercet. Biol., Ser. Zool.
Studii si Cercetari de Biologie, Seria Zoologie (Romania)

Stud. Cercet. Chim.
Studii si Cercetari de Chimie (Romania)

Stud. Cercet. Energ. Electroteh.
Studii si Cercetari de Energetica si Electrotehnica (Romania)

Stud. Cercet. Fiz.
Studii si Cercetari de Fizica (Formerly Academia Republicii Populare Romine, Institutul de Fizica Atomica si Institutul de Fizica, Studii si Cercetari de Fizica) (Romania)

Stud. Geophys. Geod.
Studia Geophysica et Geodaetica, Ceskoslovenska Akademie Ved (Czechoslovakia)

Stud. Teh. Econ., Inst. Geol. (Rom.), Ser. D
Studii Tehnice si Economice, Institutul Geologic (Romania), Seria D. Prospectiuni Geofizice (Romania)

Stud. Univ. Babes-Bolyai, Ser. Chem.
Studia Universitatis Babes-Bolyai, Series Chemia (Romania)

Stud. Univ. Babes-Bolyai, Ser. Phys.
Studia Universitatis Babes-Bolyai, Series Physica (Romania)
Continues in part Studia Universitatis Babes-Bolyai, Series Mathematica-Physica

Sulzer Tech. Rev.
Sulzer Technical Review (Switzerland)

Sumitomo Kinzoku
Sumitomo Kinzoku (Sumitomo Metals) (Japan)

Sumitomo Search
Sumitomo Search (Japan)

Surface Sci.
Surface Science (Netherlands)

Svar. Proizv.
Svarochnoe Proizvodstvo (U.S.S.R.)
Issued in English Translation as Welding Production (USSR)

Sv. Kraftverksfoereningens Publ.
Svenska Kraftverksfoereningens Publikationer (Sweden)

Sv. Naturvetensk.
Svensk Naturvetenskap (Sweden)

## T

Taehan Naekwa Hakhoe Chapchi
Taehan Naekwa Hakhoe Cahpchi (Korean Journal of Internal Medicine) (South Korea)

Taisei Kensetsu Gijutsu Kenkyusho-Ho
Taisei Kensetsu Gijutsu Kenkyusho-Ho (Japan)

Tai-Wan K'o Hsueh
Tai-Wan K'o Hsueh (Formosan Science) (China (Taiwan))

Talanta
Talanta (England)

Tanpakushitsu Kakusan Koso
Tanpakushitsu Kakusan Koso (Protein, Nucleic Acid, Enzyme) (Japan)

Tanso
Tanso (Carbons) (Japan)

Tech. CEM (Co. Elec. Mec.)
Techniques CEM (Compagnie Electro-Mecanique) (France)

Tech. Mitt.
Technische Mitteilungen (West Germany)

Tech. Mitt. Krupp, Forschungsber.
Technische Mitteilungen Krupp, Forschungsberichte (West Germany)

Tech. Mod.
Technique Moderne, La (France)

Technik (Berlin)
Technik (Berlin), Die (East Germany)

Technology (Sindri)
Technology (Sindri). Quarterly Bulletin of the Planning and Development Div., Fertilizer Corp. of India Ltd. (India)

Technol. Rep. Osaka Univ.
Technology Reports of the Osaka University (Japan)

Technol. Rep. Tohoku Univ.
Technology Reports of the Tohoku University (Japan)

Technol. Rev.
Technology Review (U.S.)

Tech. Rev., Mitsubishi Heavy Ind.
Technical Review, Mitsubishi Heavy Industries (English Edition of Mitsubishi Juko Giho) (Japan)

Tech. Rundsch. Sulzer
Technische Rundschau Sulzer (Switzerland)

Tech. Ueberwach.
Technische Ueberwachung (West Germany)

Tech. Zukunft
Techniken der Zukunft (West Germany)

Tekhnol. Organ. Proizvod.
Tekhnologiya i Organizatsiya Proizvodstva
(Ukrainian S.S.R.)

Tek. Tidskr.
Teknisk Tidskrift (Sweden)

Tellus
Tellus. A Quarterly Journal of Geophysics (Sweden)

Tensor
Tensor (Japan)

Teor. Eksp. Khim.
Teoreticheskaya i Eksperimental'naya Khimiya
(Ukrainian S.S.R.)
Issued in English Translation as Theoretical and
Experimental Chemistry (USSR)

Teor. Mat. Fiz.
Teoreticheskaya i Matematicheskaya Fizika (U.S.S.R.)

Teratology
Teratology (U.S.)

Termotecnica (Milan)
Termotecnica, La (Milan) (Italy)

TESLA Electron.
TESLA Electronics (Czechoslovakia)

Test., Instrum. Contr.
Testing, Instruments and Controls (Australia)

Tetrahedron
Tetrahedron. An International Journal of Organic Chemistry
(England)

Tetrahedron Lett.
Tetrahedron Letters (England)

Tetsu To Hagane
Tetsu To Hagane (Journal of the Iron and Steel Institute)
(Japan)

Tex. Med.
Texas Medicine (U.S.)

Textilis
Textilis (Belgium)

Text. Res. J.
Textile Research Journal (U.S.)

Theor. Klin. Med. Einzeldarstell.
Theoretische und Klinische Medizin in Einzeldarstellungen
(West Germany)

Therapiewoche
Therapiewoche, Die (West Germany)

Ther. Gegenw.
Therapie der Gegenwart (West Germany)

Therm. Eng. (USSR) (Engl. Transl.)
Thermal Engineering (USSR) (English Translation of
Teploenergetika) (England - U.S.)

Thin Films
Thin Films (U.S.)

Thin Solid Films
Thin Solid Films (Switzerland)

Thorax
Thorax (England)

Tidsskr. Norske Laegforen.
Tidsskrift for den Norske Laegeforening (Norway)

T.-I.-T. J. Life Sci.
T.-I.-T. (Tower International Technomedical Institute, Inc.)
Journal of Life Scienes (U.S.)

Toho Igakkai Zasshi
Toho Igakkai Zasshi (Journal of the Medical Society of Toho
University) (Japan)

Tohoku Daigaku Kagaku Keisoku Kenkyusho Hokoku
Tohoku Daigaku Kagaku Keisoku Kenkyusho Hokoku (Bulletin of
the Research Institute for Scientific Measurements,
Tohoku University) (Japan)

Tohoku J. Exp. Med.
Tohoku Journal of Experimental Medicine, the (Japan)

Tokushima Daigaku Gakugei Kiyo, Shizenkagaku
Tokushima Daigaku Gakugei Kiyo, Shizenkagaku (Journal of
Gakugei, Tokushima University, Natural Science) (Japan)

Tokushima J. Exp. Med.
Tokushima Journal of Experimental Medicine, The (Japan)

Tokyo Daigaku Kogakubu Fuzoku Sogo Shikenjo Nenpo
Tokyo Daigaku Kogakubu Fuzoku Sogo Shikenjo Nenpo (Report
of Engineering Inst., Faculty of Engineering, Tokyo
University) (Japan)

Tokyo Daigaku Uchu Koku Kenkyusho Hokoku
Tokyo Daigaku Uchu Koku Kenkyusho Hokoku (Bulletin of the
Institute of Space and Aeronautical Science, University of
Tokyo) (Japan)

Tokyo Igaku Zasshi
Tokyo Igaku Zasshi (The Tokyo Journal of Medical Sciences)
(Japan)

Tokyo Ika Daigaku Zasshi
Tokyo Ika Daigaku Zasshi (The Journal of Tokyo Medical
College) (Japan)

Tokyo Joshi Ika Daigaku Zasshi
Tokyo Joshi Ika Daigaku Zasshi (Journal of Tokyo Women's
Medical College) (Japan)

Tokyo Kogyo Shikensho Hokoku
Tokyo Kogyo Shikensho Hokoku (Reports of the Government
Chemical Industrial Research Institute, Tokyo) (Japan)
Changed to J. Nat. Chem. Lab. Ind.

Tongmul Hakhoe Ji
Tongmul Hakhoe Ji (Korean Journal of Zoology) (South Korea)

Tonind.-Ztg. Keram. Rundsch.
Tonindustrie-Zeitung und Keramische Rundschau
(West Germany)

Toshiba Rebyu
Toshiba Rebyu (Toshiba Review) (Japan)

Toshiba Rev., Int. Ed.
Toshiba Review, International Edition (Japan)

Tottori Daigaku Kyoikugakubu Kenkyu Hokoku, Shizenkagaku
Tottori Daigaku Kyoikugakubu Kenkyu Hokoku, Shizenkagaku
(Journal of the Faculty of Education, Natural Science,
Tottori University) (Japan)

Toxicol. Appl. Pharmacol.
Toxicology and Applied Pharmacology (U.S.)

Toyoda Kenkyu Hokoku
Toyoda Kenkyu Hokoku (Japan)

Trans. Amer. Fish. Soc.
Transactions of the American Fisheries Society (U.S.)

Trans. Amer. Geophys. Union
Transactions of the American Geophysical Union (U.S.)
Superseded by EOS, Trans., Amer. Geophys. Union

Trans. Amer. Microsc. Soc.
Transactions of the American Microscopical Society (U.S.)

Trans. Amer. Nucl. Soc.
Transactions of the American Nuclear Society (U.S.)

Trans. Amer. Nucl. Soc., Suppl.
Transactions of the American Nuclear Society,
Supplement (U.S.)

Trans. ASAE (Amer. Soc. Agr. Eng.)
Transactions of the ASAE (American Society of Agricultural
Engineers) (U.S.)

Trans. Bose Res. Inst. (Calcutta)
Transactions of the Bose Research Institute (Calcutta)
(India)

Trans. Indian Inst. Metals
Transactions of the Indian Institute of Metals (India)

Trans. Jap. Inst. Metals
Transactions of the Japan Institute of Metals (Sendai)
(Japan)

Trans. J. Brit. Ceram. Soc.
Transactions and Journals of the British Ceramic Society
(Incorporating British Ceramic Abstracts) (England)
Supersedes J. Brit. Ceram. Soc. and Trans. Brit. Ceram. Soc.

Translog
Translog (U.S.)

Trans. Nat. Res. Inst. Metals (Tokyo)
Transactions of the National Research Institute for Metals
(Tokyo) (Japan)

Trans. N. Y. Acad. Sci.
Transactions of the New York Academy of Sciences (U.S.)

Transplantation
Transplantation (Formerly Transplantation Bulletin) (U.S.)

Transp.-Med. Vesti
Transportno-Meditsinski Vesti (Bulgaria)

Transp. Theory Statist. Phys.
Transport Theory and Statistical Physics (U.S.)

Tr. Fiz. Inst., Akad. Nauk SSSR
Trudy Fizicheskogo Instituta Imeni P. N. Lebedeva, Akademiya
Nauk SSSR (U.S.S.R.)
Issued in English Translation as Proceedings (Trudy) of the
P. N. Lebedev Physics Institute

Tr. Gruz. Politekh. Inst.
Trudy Gruzinskogo Politekhnicheskogo Instituta
(Georgian S.S.R.)

Trib. CEBEDEAU (Cent. Belge Etude Doc. Eaux)
Tribune du CEBEDEAU (Centre Belge d'Etude et de
Documentation des Eaux) (Belgium)

Tr., Inst. Eksp. Meteorol.
Trudy, Institut Eksperimental'noi Meteorologii (U.S.S.R.)

Tr. Inst. Elektrokhim., Akad. Nauk SSSR, Ural. Filial
Trudy Instituta Elektrokhimii, Akademiya Nauk SSSR,
Ural'skii Filial (U.S.S.R.)
Changed to Tr. Inst. Elektrokhim., Ural. Nauch. Tsentr,
Akad. Nauk

Tr. Inst. Elektrokhim., Ural. Nauch. Tsentr. Akad. Nauk SSSR
Trudy Instituta Elektrokhimii, Ural'skii Nauchnyi Tsentr,
Akademiya Nauk SSSR (U.S.S.R.)
Supersedes Tr. Inst. Elektrokhim., Akad. Nauk SSSR,
Ural. Filial

Tr. Inst. Fiz. Astron., Akad. Nauk Est. SSR
Trudy Instituta Fiziki i Astronomii, Akademiya Nauk
Estonskoi SSR (Estonian S.S.R.)

Tr. Inst. Khim. Nauk, Akad. Nauk Kaz. SSR
Trudy Instituta Khimicheskikh Nauk, Akademiya Nauk
Kazakhskoi SSR (Kazakh S.S.R.)

Tr. Inst. Zashch. Rast., Tiflis
Trudy Instituta Zashchity Rastenii, Tiflis (Georgian S.S.R.)

Tr. Kaz. Politekh. Inst.
Trudy Kazakhskogo Politekhnicheskogo Instituta
(Kazakh S.S.R.)

Tr. Khim. Khim. Tekhnol.
Trudy po Khimii i Khimicheskoi Tekhnologii (U.S.S.R.)

Tr. Kurgan. Mashinostroit. Inst.
Trudy Kurganskogo Mashinostroitel'nogo Instituta (U.S.S.R.)

Tr. Leningrad. Politekh. Inst.
Trudy Leningradskogo Politekhnicheskogo Instituta imeni
M. I. Kalinina (U.S.S.R.

Tr. Mineral. Muz., Akad. Nauk SSSR
Trudy Mineralogicheskogo Muzeya, Akademiya Nauk SSSR
(U.S.S.R.)

Tr., Mosk. Aviats. Inst., Sb. Statei
Trudy, Moskovskii Aviatsionnyi Institut imeni S.
Ordzhonikidze, Sbornik Statei (U.S.S.R.)

Tr. Mosk. Energ. Inst.
Trudy Moskovskogo Energeticheskogo Instituta (U.S.S.R.)

Tr., Mosk. Inst. Elektron. Mashinostr.
Trudy, Moskovskii Institut Elektronnogo Mashinostroeniya
(U.S.S.R.)

Tr. Mosk. Khim.-Tekhnol. Inst.
Trudy Moskovskogo Khimiko-Tekhnologicheskogo Instituta imeni
D. I. Mendeleeva (U.S.S.R.)

Tr. Novocherkassk. Politekh. Inst.
Trudy Novocherkasskogo Politekhnicheskogo Instituta
(U.S.S.R.)

Tr. Shemakh. Astrofiz. Observ., Akad. Nauk Azerb. SSR
Trudy Shemakhinskoi Astrofizicheskoi Observatorii, Akademiya
Nauk Azerbaidzhanskoi SSR (Azerbaidzhan S.S.R.)

Tr. Soyuznogo Nauch.-Issled. Inst. Priborostr.
Trudy Soyuznogo Nauchno-Issledovatel'skogo Instituta
Priborostroeniya (U.S.S.R.)

Tr. Tambov. Inst. Khim. Mashinostr.
Trudy Tambovskogo Instituta Khimicheskogo
Mashinostroeniya (U.S.S.R.)

Tr. Ural. Politekh. Inst.
Trudy Ural'skogo Politekhnicheskogo Instituta imeni
S. M. Kirova (U.S.S.R.)

Tr. Voronezh. Tekhnol. Inst.
Trudy Voronezhskogo Tekhnologicheskogo Instituta
(U.S.S.R.)

Tr. Vses. Nauch.-Issled. Inst. Elektromekh.
Trudy Vsesoyuznogo Nauchno-Issledovatel'skogo
Instituta Elektromekhaniki (U.S.S.R.)

Tr. Vses. Nauch.-Issled. Inst. Khim. Reaktivov
Trudy Vsesoyuznogo Nauchno-Issledovatel'skogo Instituta
Khimicheskikh Reaktivov (U.S.S.R.)

Tr., Vses. Nauch.-Issled. Inst. Khim. Reaktivov Osobo
Chist. Khim. Veshchestv
Trudy, Vsesoyuznyi Nauchno-Issledovatel'skii Institut
Khimicheskikh Reaktivov i Osobo Chistykh Khimicheskikh
Veshchestv (U.S.S.R.)

Tr. Vses. Nauch.-Issled. Inst. Stand. Obraztsov Spektr.
Etalonov
Trudy Vsesoyuznogo Nauchno-Issledovatel'skogo Instituta
Standartnykh Obraztsov i Spektral'nykh Etalonov (U.S.S.R.)

Tr., Vses. Nauch.-Issled. Inst. Yadern.
Geofiz. Geokhim.
Trudy, Vsesoyuznyi Nauchno-Issledovatel'skii Institut
Yadernoi Geofiziki i Geokhimii (U.S.S.R.)

Tsitol. Genet.
Tsitologiya i Genetika (Ukrainian S.S.R.)

Tsitologiya
Tsitologiya (U.S.S.R.)

Tsvetn. Metal.
Tsvetnye Metally (U.S.S.R.)
For English Translation see the Soviet Journal of
Non-Ferrous Metals

Tungsten News
Tungsten News (U.S.)

Turrialba
Turrialba (Costa Rica)

## U

Uch. Zap. Azerb. Gos. Univ., Ser. Khim. Nauk
Uchenye Zapiski Azerbaidzhanskogo Gosudarstvennogo
Universiteta im. S. M. Kirova, Seriya Khimicheskikh Nauk
(Azerbaidzhan S.S.R.)

Uch. Zap., Azerb. Inst. Nefti Khim., Ser. 9
Uchenye Zapiski, Azerbaidzhanskii Institut Nefti i
Khimii, Seriya 9 (Azerbaidzhan S.S.R.)

Uch. Zap. Erevan. Univ., Estestv. Nauk
Ucheneye Zapiski Erevanskogo Universiteta, Estestvennykh
Nauk (Armenian S.S.R.)

Uch. Zap. Leningrad. Gos. Univ., Ser. Fiz. Geol. Nauk
Uchenye Zapiski Leningradskogo Gosudarstvennogo Universiteta
im. A. A. Zhdanova, Seriya Fizicheskikh i Geologicheskikh
Nauk (U.S.S.R.)

Uch. Zap. Leningrad. Gos. Univ., Ser. Mat. Nauk
Uchenye Zapiski Leningradskogo Gosudarstvennogo Ordena
Lenina Universite imeni A. A. Zhdanova, Seriya
Matematicheskikh Nauk (U.S.S.R.)

Uch. Zap. Petrozavodsk. Gos. Univ.
Uchenye Zapiski Petrozavodskogo Gosudarstvennogo
Universiteta (U.S.S.R.)

Ukr. Biokhim. Zh.
Ukrainskii Biokhimichnii Zhurnal (Ukrainian S.S.R.)

Ukr. Fiz. Zh. (Russ. Ed.)
Ukrainskii Fizicheskii Zhurnal (Russian Edition)
(Ukrainian S.S.R.)

Ukr. Khim. Zh.
Ukrainskii Khimicheskii Zhurnal (Ukrainian S.S.R.)
Issued in English Translation as Soviet Progress in Chemistry

Umschau
Umschau, Die (West Germany)

Umsch. Wiss. Tech.
Umschau in Wissenschaft und Technik (West Germany)

Umwelt
Umwelt (West Germany)

Urania (Krakow)
Urania (Krakow) (Poland)

U. S., Geol. Surv., Prof. Pap.
United States Department of the Interior, Geological Survey, Professional Paper (U.S.)

Usp. Fiz. Nauk
Uspekhi Fizicheskikh Nauk (U.S.S.R.)
Issued in English Translation as Soviet Physics- Uspekhi

Usp. Fotoniki
Uspekhi Fotoniki (U.S.S.R.)

Usp. Khim.
Uspekhi Khimii (U.S.S.R.)
Issued in English Translation as Russian Chemical Reviews

Usp. Sovrem. Biol.
Uspekhi Sovremennoi Biologii (U.S.S.R.)

Usp. Sovrem. Genet.
Uspekhi Sovremennoi Genetiki (U.S.S.R.)

Uzb. Biol. Zh.
Uzbekskii Biologicheskii Zhurnal, Akademiya Nauk Uzbekskoi SSR (Uzbek S.S.R.)

Uzb. Khim. Zh.
Uzbekskii Khimicheskii Zhurnal, Akademiya Nauk Uzbekskoi SSR (Uzbek S.S.R.)

## V

Vacuum
Vacuum. The International Journal and Abstracting Service for Vacuum Research and Technology (England)

Vag- Vattenbyggaren
Vag- och Vattenbyggaren (Sweden)

VDI (Ver. Deut. Ing.) Nachr.
VDI (Verein Deutscher Ingenieure) Nachrichten (West Germany)

VDI (Ver. Deut. Ing.) Z.
VDI (Verein Deutscher Ingenieure) Zeitschrift fuer die Gesamte Technik
(Formerly VDI (Verein Deutscher Ingenieure) Zeitschrift)
(West Germany)

Verh. Kon. Vlaam. Acad. Geneesk. Belg.
Verhandelingen van de Koninklijke Vlaamse Academie voor Geneeskunde van Belgie (Belgium)

Verres Refract.
Verres et Refractaires (France)

Vesmir
Vesmir (Czechoslovakia)

Vestn. Akad. Nauk Kaz. SSR
Vestnik Akademii Nauk Kazakhskoi SSR (Kazakh S.S.R.)

Vestn. Beloruss. Gos. Univ., Ser. 2
Vestnik Belorusskogo Gosudarstvennogo Universiteta, Seriya 2. Biologiya, Khimiya, Geologiya, Geografiya (Belorussian S.S.R.)

Vestn. Cesk. Spolecnosti Zool.
Vestnik Ceskoslovenske Spolecnosti Zoologicke (Czechoslovakia)

Vestn. Khar'kov. Politekh. Inst.
Vestnik Khar'kovskogo Politekhnicheskogo Instituta (Ukrainian S.S.R.)

Vestn. Leningrad. Univ., Fiz., Khim.
Vestnik Leningradskogo Universiteta, Fizika, Khimiya (Formerly Vestnik Leningradskogo Universiteta, Seriya Fiziki i Khimii) (U.S.S.R.)

Vestn. Leningrad. Univ., Geol., Geogr.
Vestnik Leningradskogo Universiteta, Geologiya, Geografiya (Formerly Vestnik Leningradskogo Universiteta, Seriya Geologii i Geografii) (U.S.S.R.)

Vestn. Leningrad. Univ., Mat., Mekh., Astron.
Vestnik Leningradskogo Universiteta, Matematika, Mekhanika, Astronomiya (Formerly Vestnik Leningradskogo Universiteta, Seriya Matematiki, Mekhaniki i Astronomii) (U.S.S.R.)

Vestn. Mashinostr.
Vestnik Mashinostroeniya (U.S.S.R.)
Issued in English translation as Russ. Eng. J.

Vestn. Mosk. Univ., Biol. Pochvoved.
Vestnik Moskovskogo Universiteta, Biologiya, Pochvovedenie (Continues in part Vestnik Moskovskogo Universiteta, Seriya Biologii, Pochvovedeniya, Geologii, Geografii) (U.S.S.R.)

Vestn. Mosk. Univ., Ser. II. Khim.
Vestnik Moskovskogo Universiteta, Seriya II. Khimiya (Formerly a Part of Vestnik Moskovskogo Universiteta, Seriya Matematiki, Mekhaniki, Astronomii, Fiziki i Khimii) (U.S.S.R.)

Vestn. Mosk. Univ., Ser. III. Fiz. Astron.
Vestnik Moskovskogo Universiteta, Seriya III. Fizika, Astronomiya (U.S.S.R.)

Vestn. Rentgenol. Radiol.
Vestnik Rentgenologii i Radiologii (U.S.S.R.)

Vestn. Slov. Kem. Drus.
Vestnik Slovenskega Kemijskega Drustva (Yugoslavia)

Vestn. Zool.
Vestnik Zoologii (Ukrainian S.S.R.)

Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk
Vestsi Akademii Navuk Belaruskai SSR, Seryya Fizika-Energetychnykh Navuk (Belorussian S.S.R.)

Vestsi Akad. Navuk BSSR, Ser. Biyal. Navuk
Vestsi Akademii Navuk BSSR, Seryya Biyalagichnykh Navuk (Formerly Carried as Vestsi Akademii Navuk Belaruskai SSR, Seryya Biyalagichnykh Navuk) (Belorussian S.S.R.)

Vestsi Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk
Vestsi Akademii Navuk BSSR, Seryya Fizika-Matematychnykh Navuk (Belorussian S.S.R.)

Veterinariya
Veterinariya (U.S.S.R.)

Veterinarstvi
Veterinarstvi (Czechoslovakia)

Vet. Med. (Prague)
Veterinarni Medicina (Prague) (Czechoslovakia)

VFDB (Ver. Foerder. Deut. Brandschutzes) Z.
VFDB (Vereinigung zur Foerderung des Deutschen Brandschutzes) Zeitschrift fuer Forschung und Technik im Brandschutz (West Germany)

VGB Kraftwerkstechnik
VGB Kraftwerkstechnik (West Germany)

Vide
Vide, Le, Technique-Applications (France)

Vijnana Parishad Anusandhan Patrika
Vijnana Parishad Anusandhan Patrika (India)

Virchows Arch., B
Virchows Archiv, B. Zellpathologie (Formerly Frankfurter Zeitschrift fuer Pathologie) (West Germany)

Virology
Virology (U.S.)

Vishwakarma
Vishwakarma (India)

Visn. Kiiv. Politekh. Inst., Ser. Khim. Mashinobuduv. Tekhnol.
Visnik Kiivs'kogo Politekhnichnogo Institutu, Seriya Khimichnogo Mashinobuduvannya ta Tekhnologii (Ukrainian S.S.R.)
26

Visn. Kiiv. Univ., Ser. Biol.
Visnik Kiivs'kogo Universitetu, Seriya Biologii (Ukrainian S.S.R.)

Vitis
Vitis (West Germany)

Vnitr. Lek.
Vnitrni Lekarstvi (Czechoslovakia)

Vod. Hospod., B
Vodni Hospodarstvi, B (Czechoslovakia)

Voenno Med. Delo
Voenno Meditsinsko Delo (Bulgaria)

Vojnosanit. Pregl.
Vojnosanitetski Pregled (Yugoslavia)

Voj. Zdravot. Listy
Vojenske Zdravotnicke Listy (Czechoslovakia)

Vop. Fiz. Zashch. Reaktorov
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Vuoto Sci. Technol.
Vuoto Scienza e Technologia (Italy)

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Waerme, Die (West Germany)

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Waseda Daigaku Rikogaku Kenkyusho Hokoku (Bulletin of the
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Wear (Netherlands)

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Wiadomosci Chemiczne (Poland)

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Wire Industry (England)

Wire J.
Wire Journal (U.S.)

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Wissenschaft, Wirtschaft, Politik (West Germany)

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Wissenschaftliche Zeitschrift der Technischen Hochschule
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World Mining (U.S.)

## X

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## Y

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ZIS (Zentralinstitut fuer Schweisstechnik)-Mitteilungen
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Zeitschrift fuer Lebensmittel-Untersuchung und -Forschung
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Zeitschrift fuer Metallkunde (West Germany)

Z. Naturforsch., a
Zeitschrift fuer Naturforschung, Teil a (West Germny)

Z. Naturforsch., b
Zeitschrift fuer Naturforschung, Teil b

Zool. Zh.
Zoologicheskii Zhurnal (U.S.S.R.)

Z. Pflanzenernaehr. Bodenk.
Zeitschrift fuer Pflanzenernaehrung und Bodenkunde (Formerly
Zeitschrift fuer Pflanzenernaehrung Duengung Bodenkunde)
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Zeitschrift fuer Pflanzenphysiologie (West Germany)

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Zeitschrift fuer Pflanzenzuechtung (West Germany)

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Zeitschrift fuer Physik (West Germany)

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